

Cave Drip Monitoring

Fiscal Year 2020 Report



Prepared by 4CAVES Institute P.B.C.

For the City of Austin - Austin Water Utility - Wildland Conservation Division

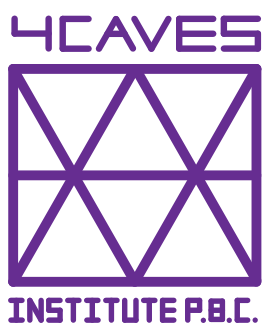


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Cover Photo: Aggie Level in District Park Cave with Cave Specialist Ethan Perrine.

Introduction

This report is an update to the status of ongoing cave drip monitoring activities within caves associated with the Balconies Canyonlands Preserve (BCP). This report covers monitoring conducted during the City of Austin 2020 fiscal year, which ran from October 1, 2019 through September 30, 2020.

This monitoring and research were conducted for the City of Austin – Austin Water Utility – Wildlands Conservation Division in assistance of compliance with their federal permit commitments associated with the Balconies Canyonlands Conservation Plan (BCCP).

We conducted drip rate measurements at 15 sites within 5 caves. Most drip rate measurements were automated, while others were conducted manually. Our efforts during 2020 produced 271,758 new drip rate measurements, bringing our full drip rate data set to a total of 1,439,394 drip rate measurements recorded since August of 2012.

Within Flint Ridge Cave we collected 113 water samples from 7 sites during 5 sampling trips. Of these samples 60 were collected using an isco 6712 Autosampler, while 53 were collected as grab samples.

Specifications used for conducting these hydrogeological studies are provided in Hauwert, N., and Cowan, B. 2013, Delineating Source Areas To Cave Drips And Cave Streams In Austin Texas, USA: 13th Sinkhole Conference, Carlsbad, NM. https://www.researchgate.net/publication/313013527_Delineating_Source_Areas_to_Cave_Drips_and_Cave_Streams_in_Austin_Texas_USA

All trips were safely conducted in adherence to regulations and best practices applicable to the COVID-19 pandemic.



Flint Ridge Cave

Flint Ridge Cave is one of the most significant caves of the 62 that were committed for protection under the Balconies Canyonlands Conservation Plan. Today the entrance of the cave serves as a significant recharge feature for the Barton Springs Segment of the Edwards Aquifer. In the spring of 1984 cavers from the Underground Texas Grotto dug into the cave through a dirt and rock plug in the corner of a sinkhole. Prior to this the sinkhole was plugged, likely in an effort to keep water at the surface for livestock. Observable speleogenic evidence within the cave indicates it had formed with an open entrance.

While the surface catchment can appear obvious, there is a cryptic subterranean network of passages which link numerous nearby karst features into the larger Flint Ridge Cave system. This is observable within Flint Ridge Cave as there are thousands of cave drips, each of which is feeding water through the vadose zone of the Edwards Aquifer.

Selected for ongoing study are 6 cave drip monitoring stations that are representative of the character of the cave drips throughout the cave. Some of these drip stations are individual speleothem formations, while others are groups of dripping formations captured on a tarp and funneled together.



Cave Specialist Alec Bellamy calibrating the Balcony Joint drip monitoring station.

Flint Ridge Cave

Travis County Texas

Traverse Length 1,738 ft

Maximum Depth Below Datum 153 ft

Maximum Depth Below Surface 151 ft

Cartography by Justin Shaw

June 2018

Magnetic Declination at Publication +3.8°

DistoX2 Survey by

Justin Shaw

Mason Lewis

Kevin Walsh

Rich Zarria

Galen Falgout

Dylan Beeler

Amy Morton

Kraig Fenton

Devra Heyer

Ellie Watson

Peter "Dash" Gott

Mimi Alexander

Mary Hicks

Davey Siddons

July 2017 through November 2017

Cave Radio Location Survey by

Keith Heuss

Nico Hauwert

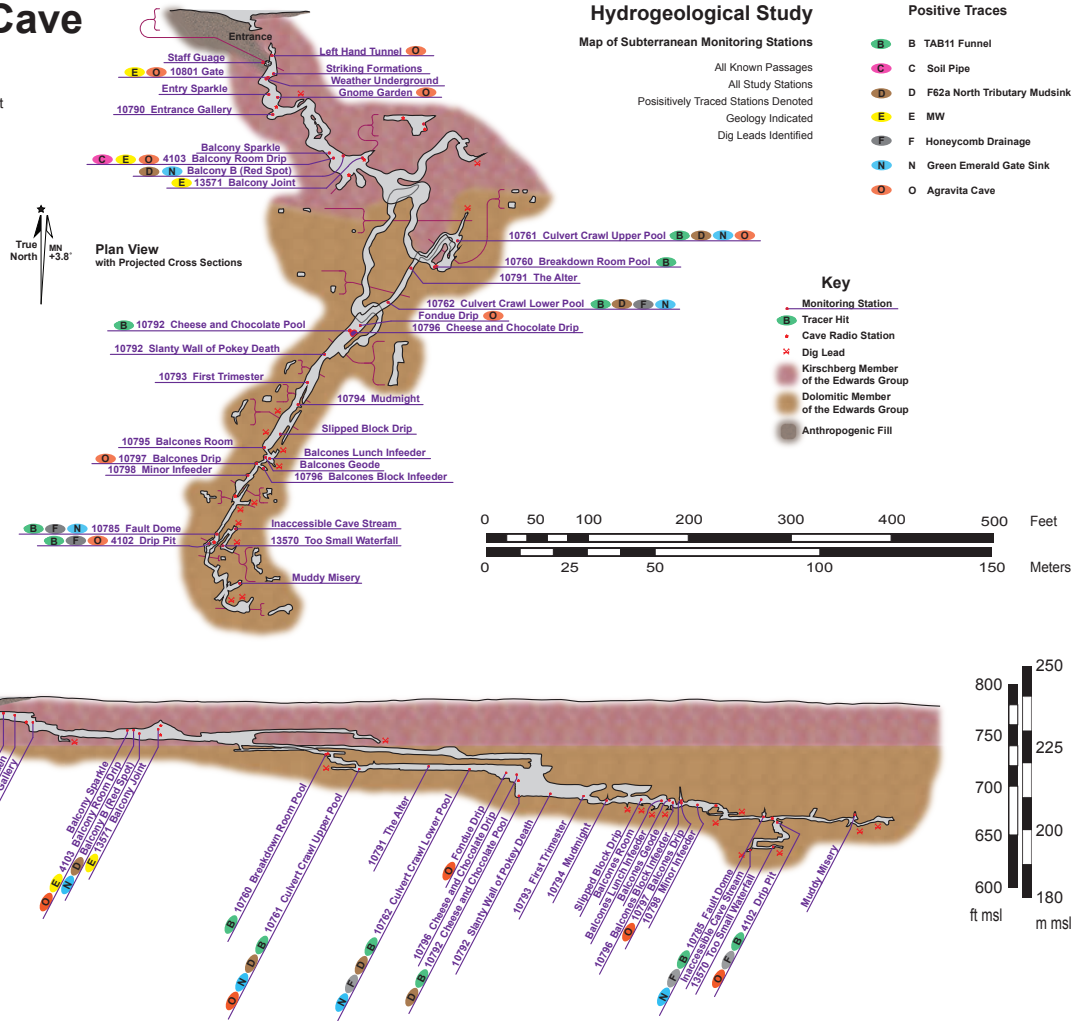
Bill Russell

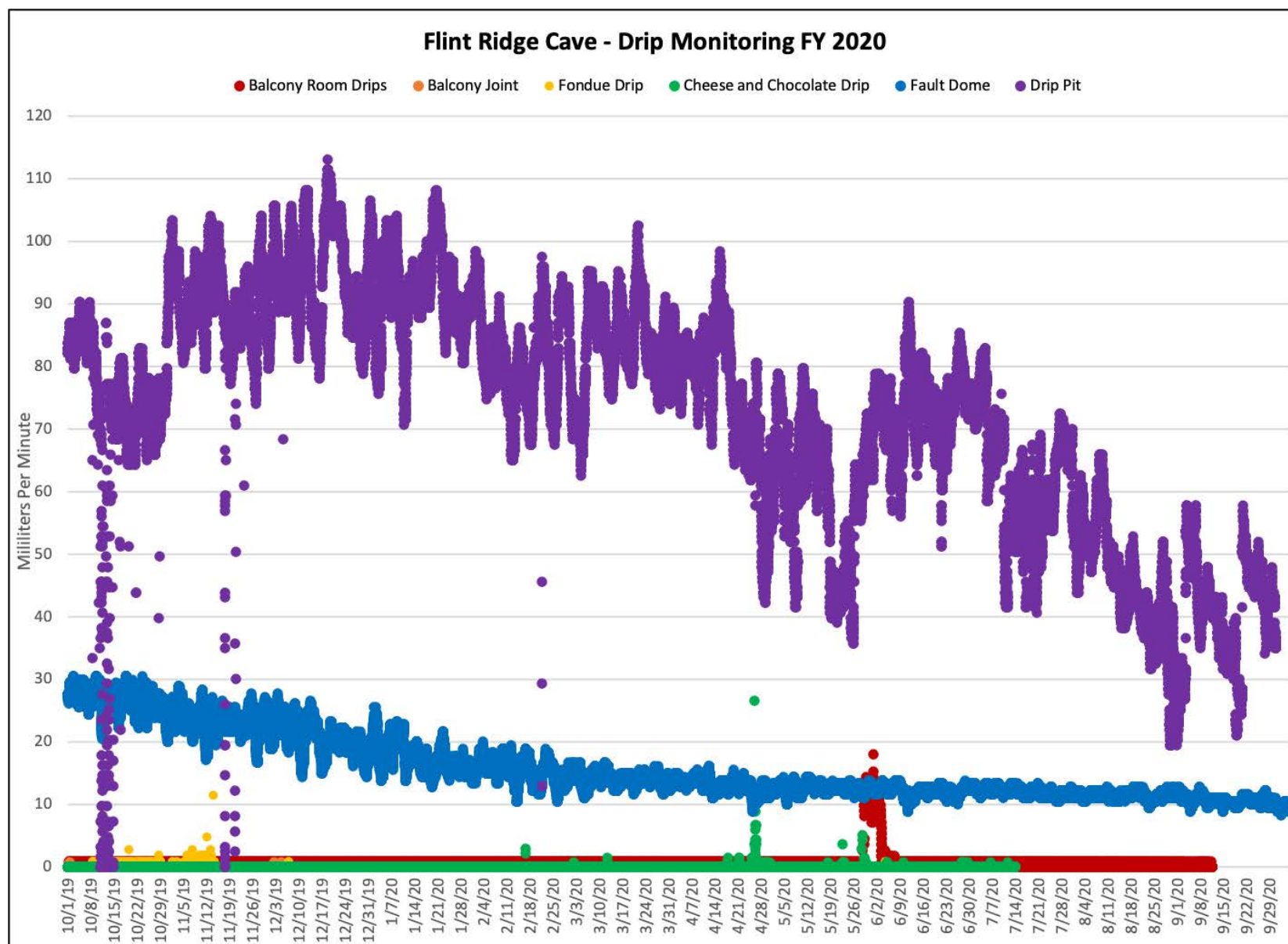
Julie Jenkins

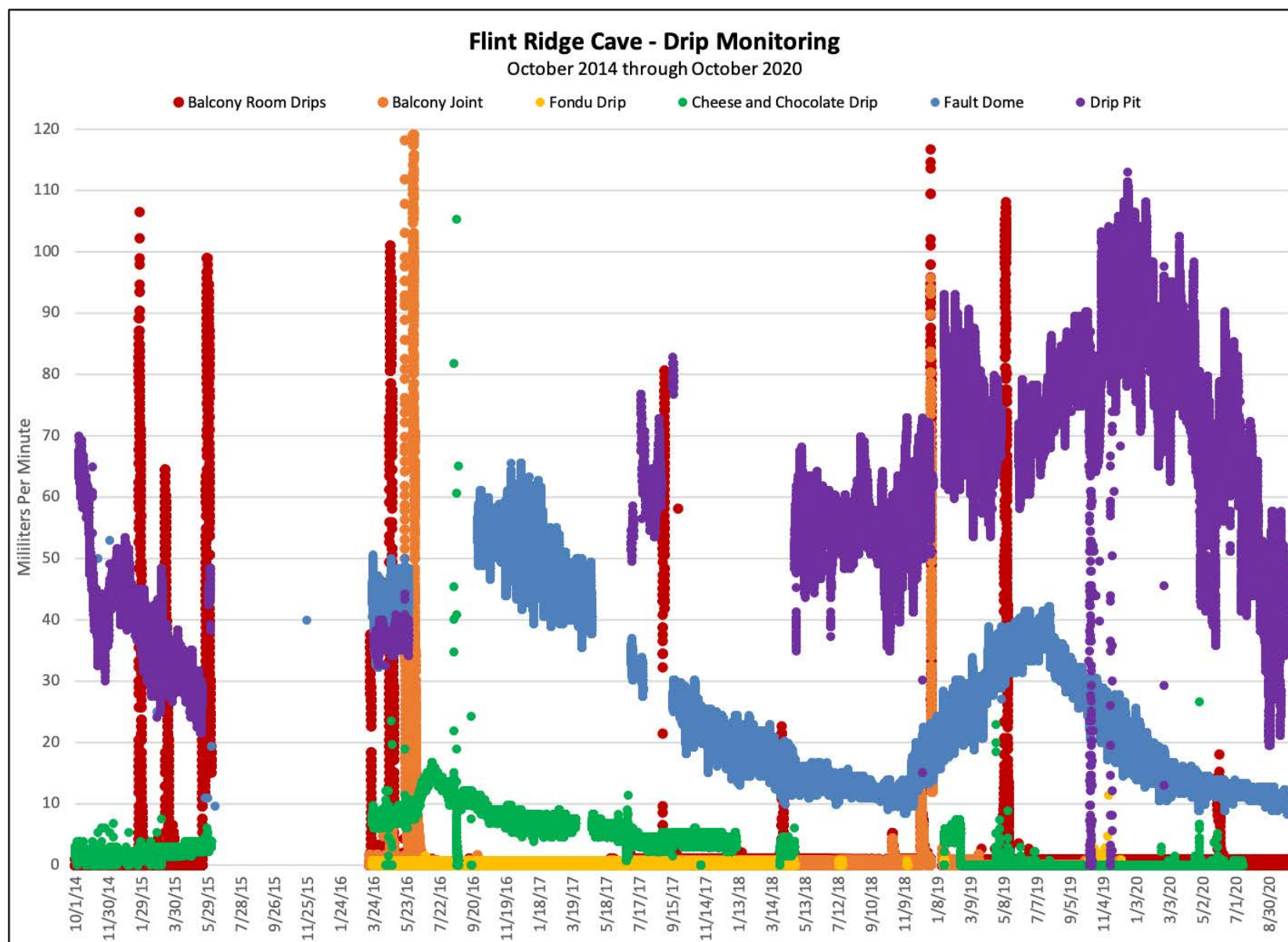
April 2006

This map was drafted solely

from the DistoX2 data set.







Balcony Room Drips

Discrete Cave Drip

This site is a group of stalactites located at an elevation of 755.8 ft msl and is within the Kirschberg Member of the Edwards Group. These formations only drip as a rapid response to rain events.

Statistical volumes below are in milliliters per minute.

35,130 drip rate measurements during 2020.

Mean 0.22 – Minimum 0.00 – Maximum 18.01

149,633 drip rate measurements since October 2014.

Mean 2.04 – Minimum 0.00 – Maximum 116.70

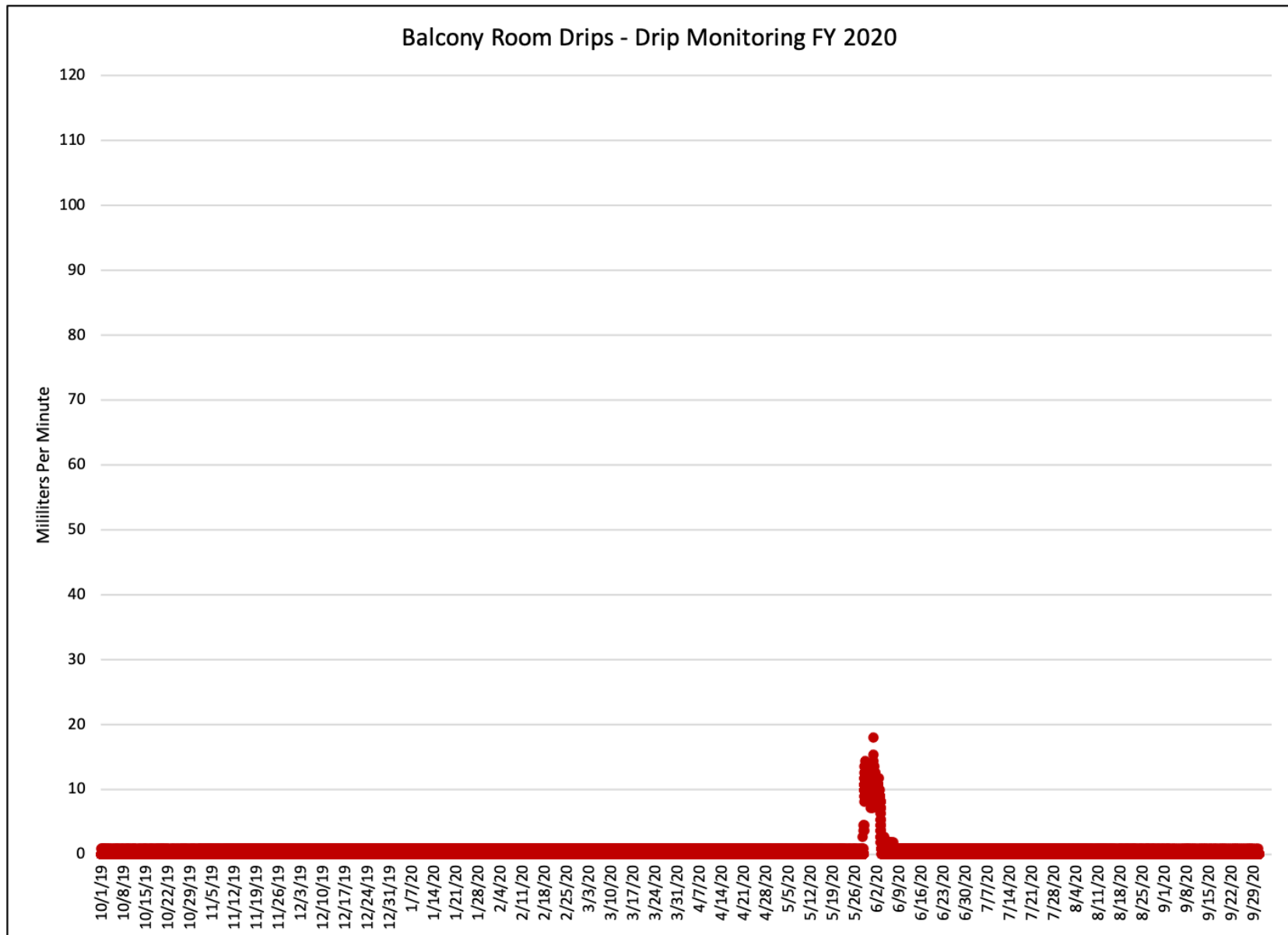
Deviation of 2020 drip rates from complete record:

Mean -1.82 – Minimum 0.00 – Maximum -98.69

Good data collected all year.

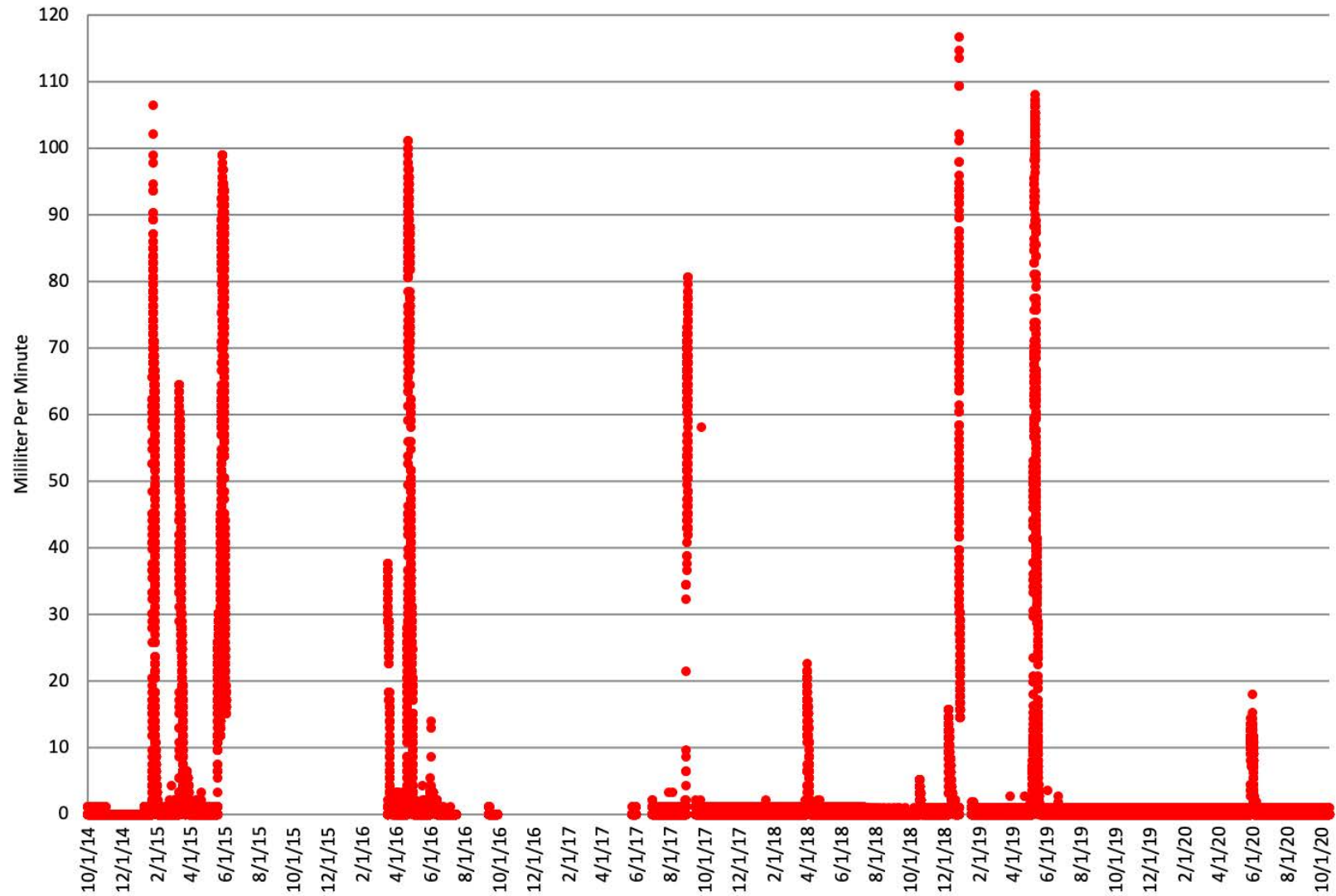
This station is currently deployed and operational. The current configuration consists of a plastic sheet tarp hung to collect the drips and funnel them through an isco 674 tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB. The RainWise tipper is suspended with a bucket hanging below it which collects just over 2 liters of water before pouring over. There is an isco 6712 Autosampler with a 23 ft suction line for drawing samples from the bucket. To keep it safer during recharge events the autosampler is suspended from the ceiling utilizing a pulley system which allows it to be lowered for sample retrieval.





Balcony Room Drips - Drip Monitoring

October 2016 through January 2020



Balcony Joint

Infeeder

This site is an infeeder located at an elevation of 756.8 ft msl and is within the Kirschberg Member of the Edwards Group. This infeeder only flows or drips as a rapid response to rain events.

Statistical volumes below are in milliliters per minute.

6,217 drip rate measurements during 2020.

Mean 0.00 – Minimum 0.00 – Maximum 0.81

97,092 drip rate measurements since March 2016.

Mean 1.17 – Minimum – 0.00 – Maximum 405.39

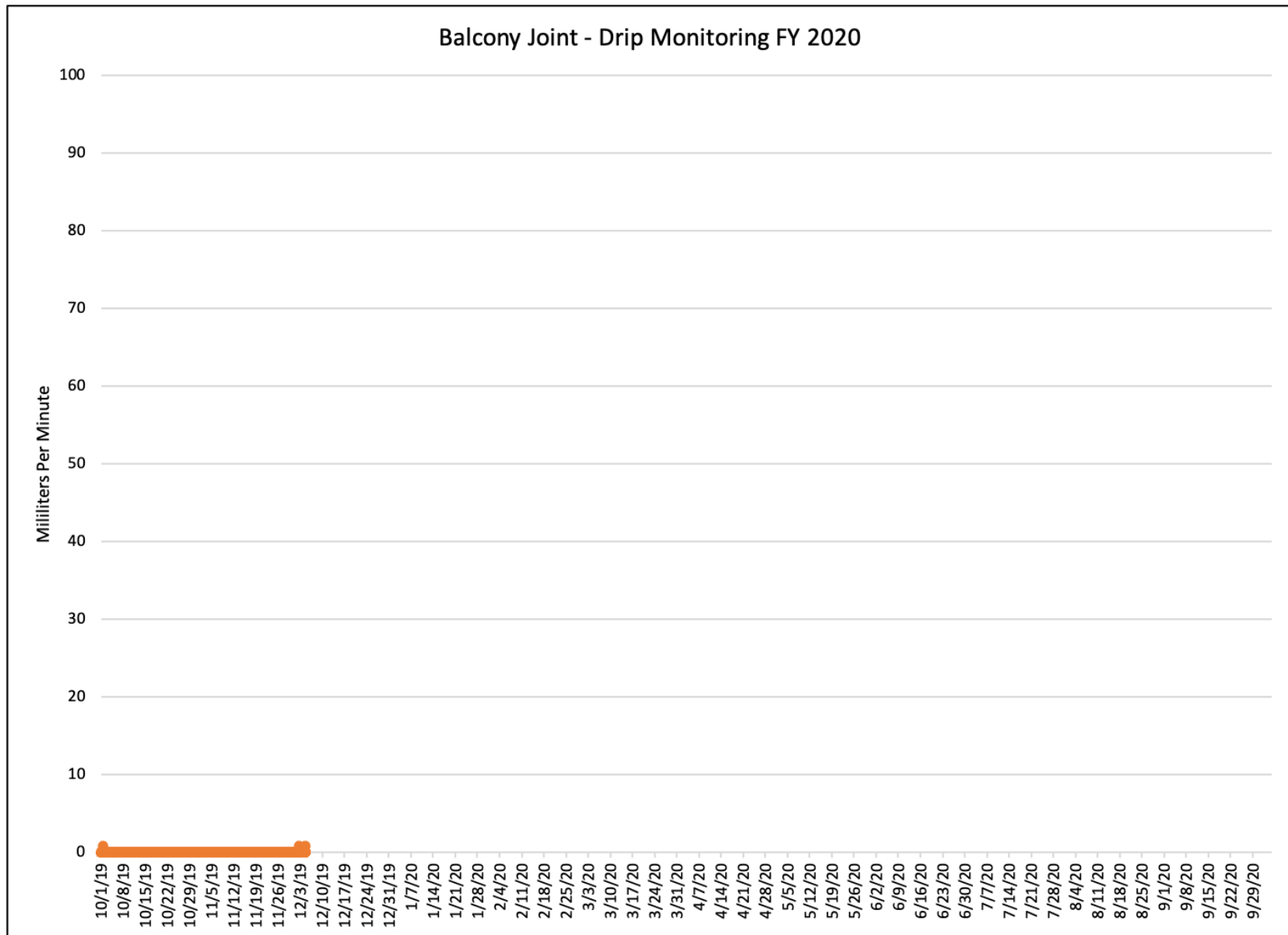
Deviation of 2020 drip rates from complete record:

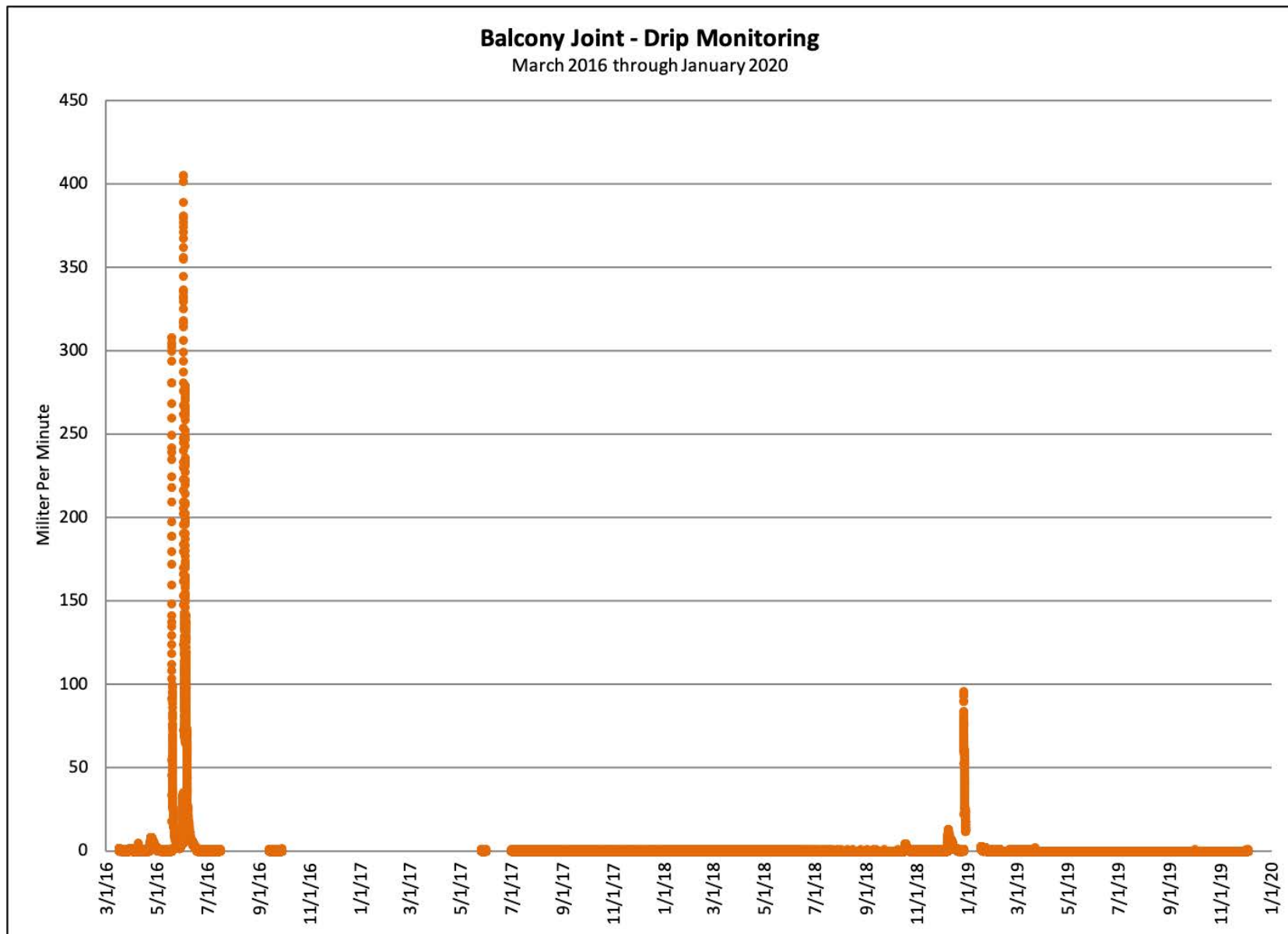
Mean -1.17 – Minimum 0.00 – Maximum -404.58

Good data collected 10/1/2019 through 12/4/2019. The gap in data beginning on 6/4/2019 was due to datalogger failure. The cause of the datalogger failure could not be determined. This datalogger was replaced on 10/15/2020.

The station is currently deployed and operational. The current configuration consists of a plastic sheet tarp hung to collect the flow and funnel it through a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64







Fondue Drip

Discrete Cave Drip

This site is a dripping formation area located at an elevation of 712.9 ft msl and is within the Dolomitic Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

23,047 drip rate measurements during 2020.

Mean 0.01 – Minimum 0.00 – Maximum 11.43

97,310 drip rate measurements since March 2016.

Mean 0.04 – Minimum – 0.00 – Maximum 11.43

Deviation of 2020 drip rates from complete record:

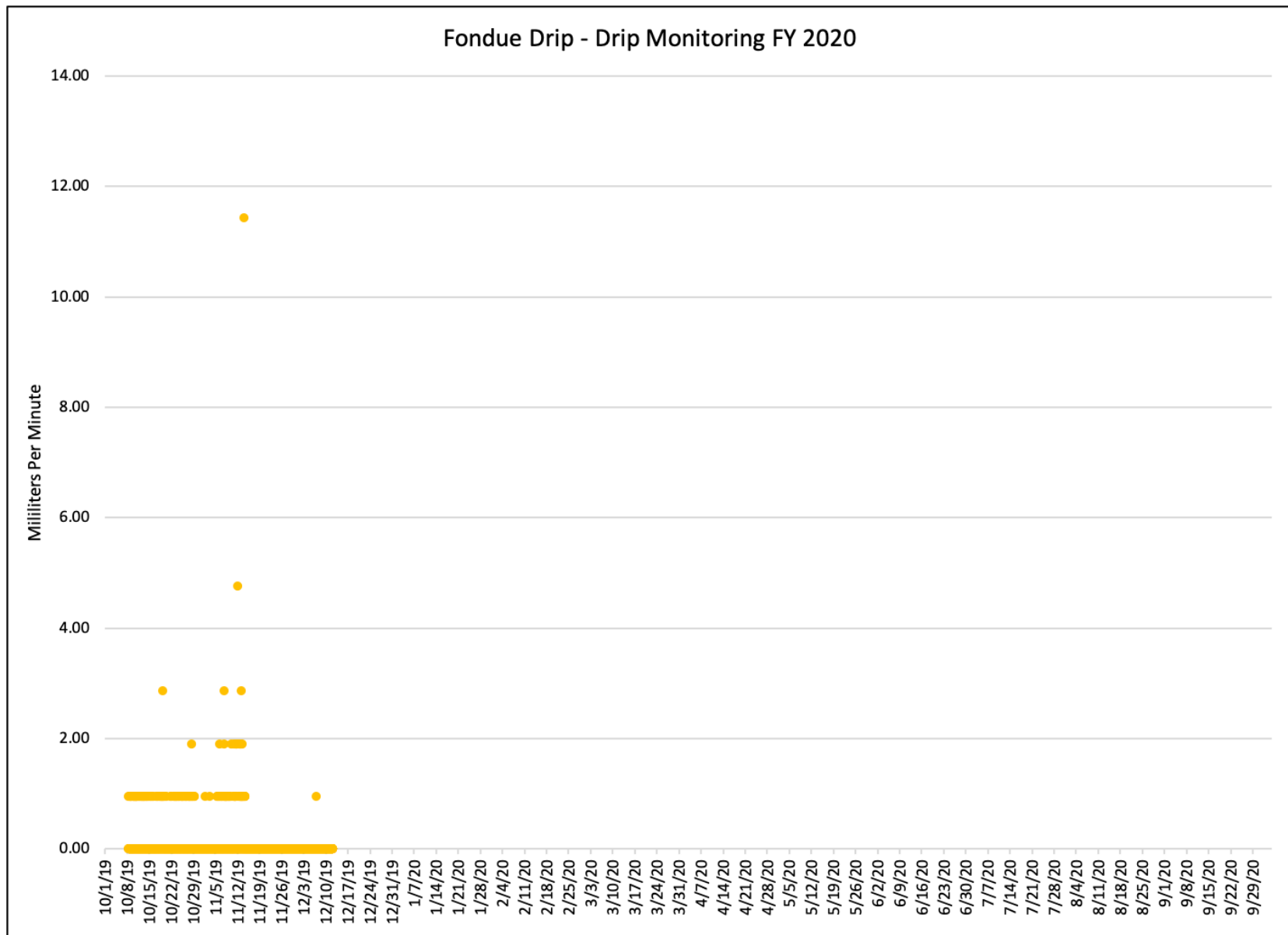
Mean -0.03 – Minimum 0.00 – Maximum 0.00

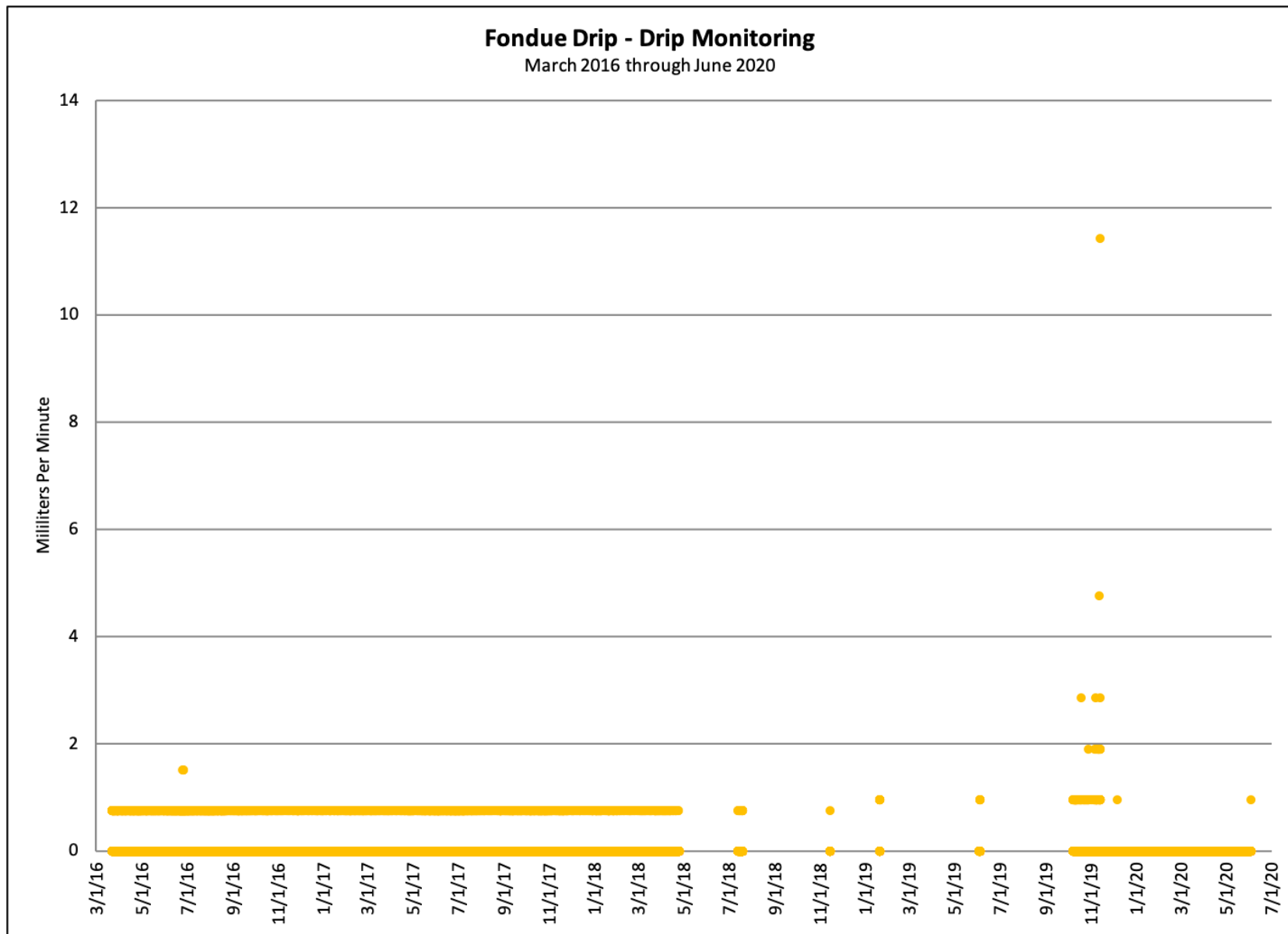
Good data collected 10/8/2019 through 6/4/2019. The gap in data beginning on 6/4/2019 was due to tipper gauge failure. The cause of the failure could not be determined.

The station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64



Cave Specialist Dylan Beeler downloading the data logger at Fondue Drip.





Cheese and Chocolate Drip

Discrete Cave Drip

This site is a collection of drips located at an elevation of 712.9 ft msl and is within the Dolomitic Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

27,547 drip rate measurements during 2020.

Mean 0.01 – Minimum 0.00 – Maximum 26.66

137,680 drip rate measurements since October 2014.

Mean 3.56 – Minimum – 0.00 – Maximum 446.07

Deviation of 2020 drip rates from complete record:

Mean **-3.55** – Minimum 0.00 – Maximum **-419.41**

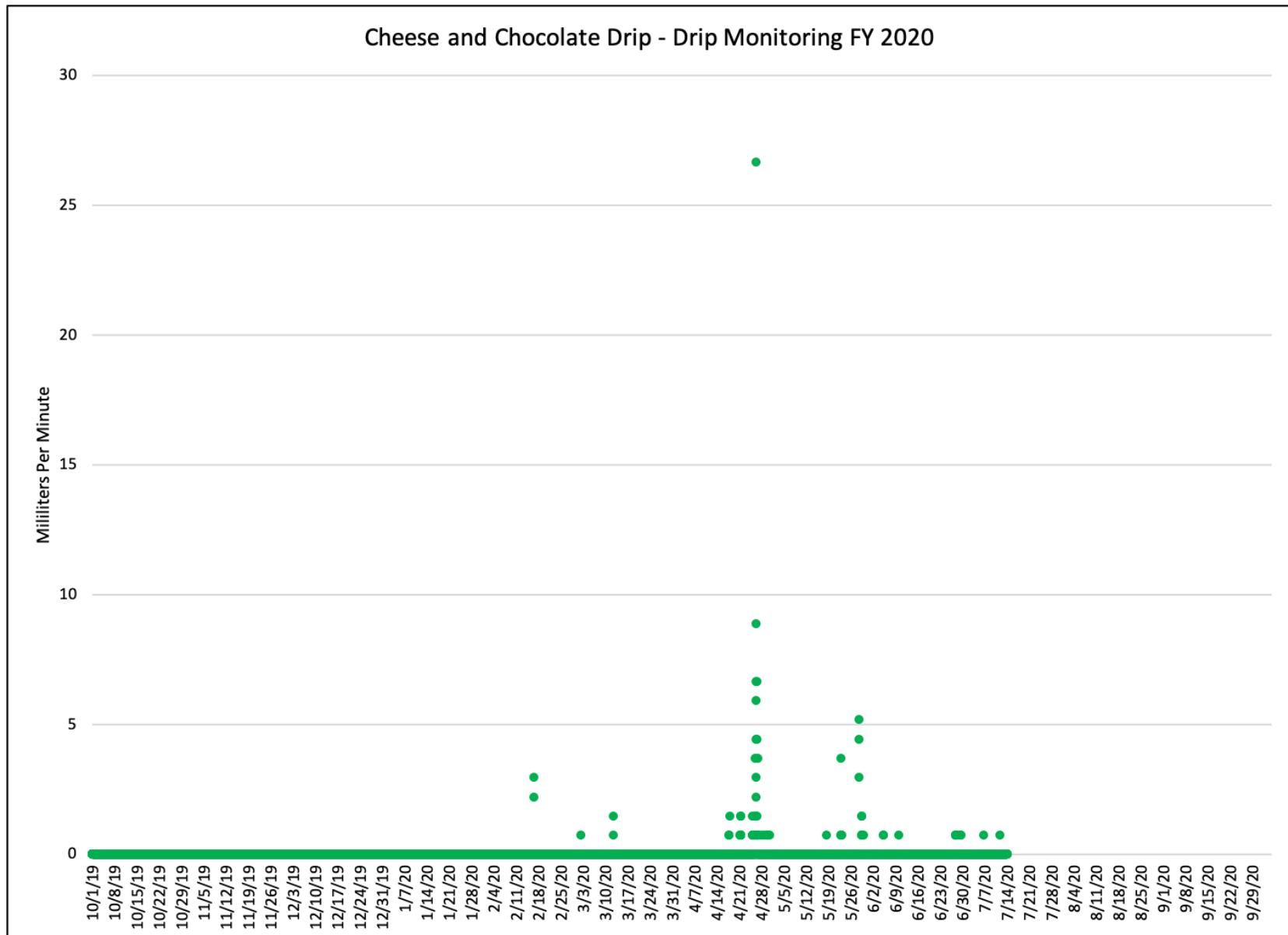
Good data collected 10/1/2019 through 7/13/2020. The gap in data beginning on 6/4/2019 was due to tipper gauge failure. The cause of the failure could not be determined.

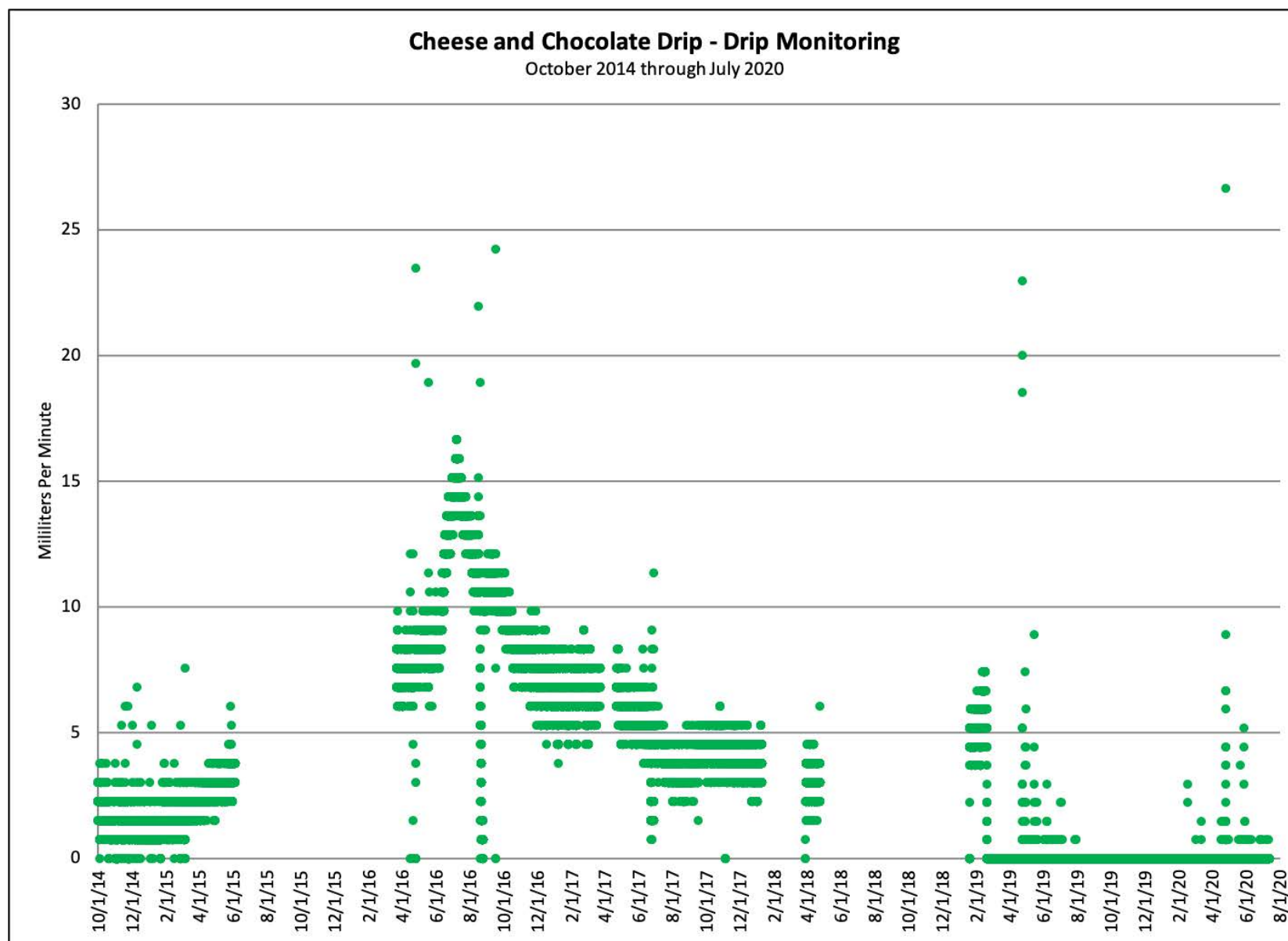
The station is currently deployed and operational. The current configuration consists of a plastic sheet tarp hung to collect the drips and funnel them through a RainWise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB. The RainWise tipper is suspended with a bucket hanging below it which collects just over 2 liters of water before pouring over.

At this same location there is also an isco 6712 Autosampler with a 71 ft suction line for drawing samples from Culvert Crawl Lower Pool. To keep it safer during recharge events the autosampler is suspended from the ceiling utilizing a pulley system which allows it to be lowered for sample retrieval.

The peculiar positioning of equipment in this area is dictated by the locations of natural rock outcroppings appropriate and competent to support anchors sufficient to carry the loads; while also keeping all equipment clear of the primary flow paths inundated during recharge events.







Fault Dome

Discrete Cave Drip

This site is a discrete cave drip located at an elevation of 669.1 ft msl and is within fault breccia of the primary fault the cave is formed along.

Statistical volumes below are in milliliters per minute.

37,085 drip rate measurements during 2020.

Mean 15.53 – Minimum 7.77 – Maximum 30.54

135,341 drip rate measurements since November 2014.

Mean 25.25 – Minimum – 7.77 – Maximum 65.53

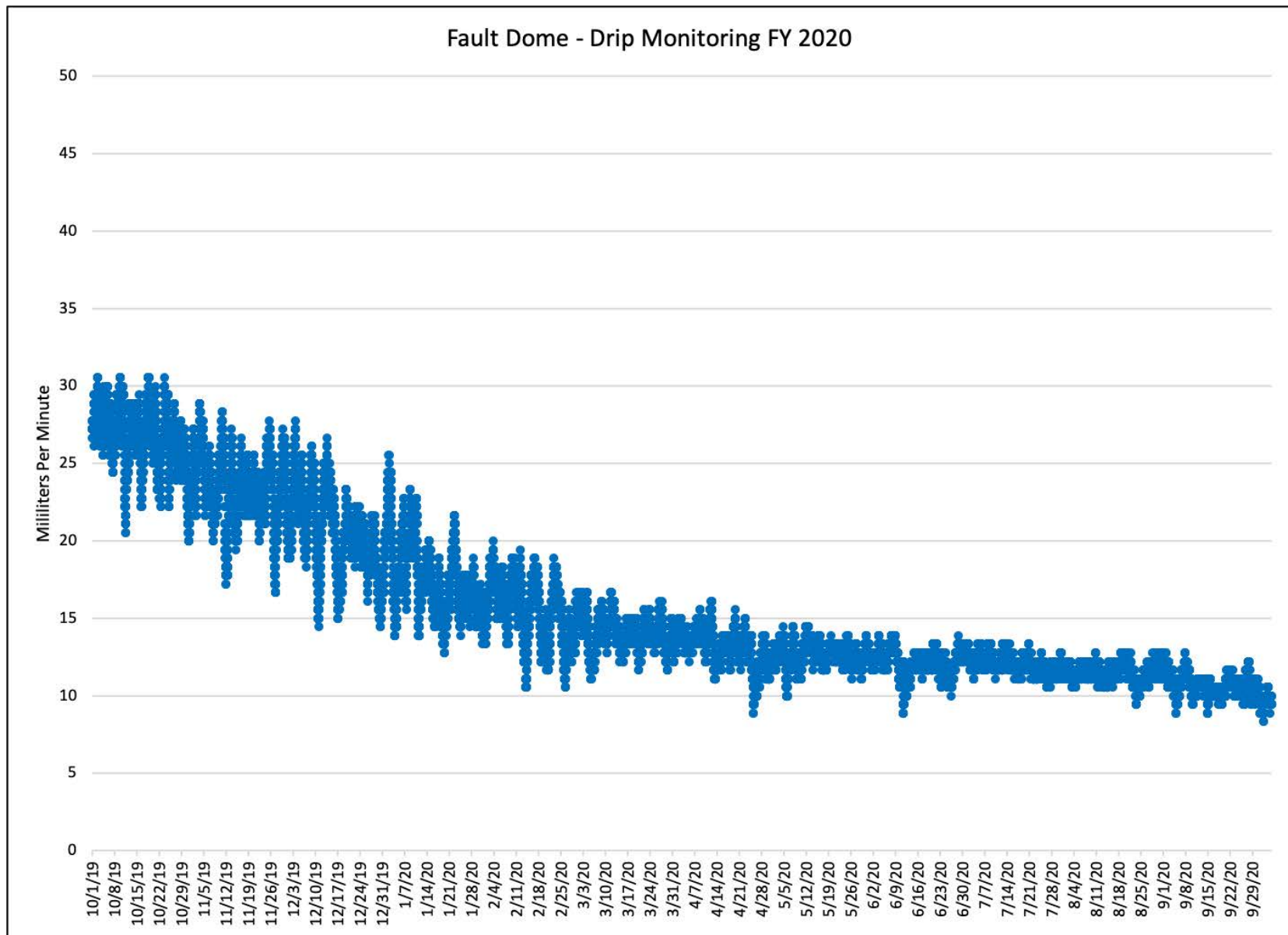
Deviation of 2020 drip rates from complete record:

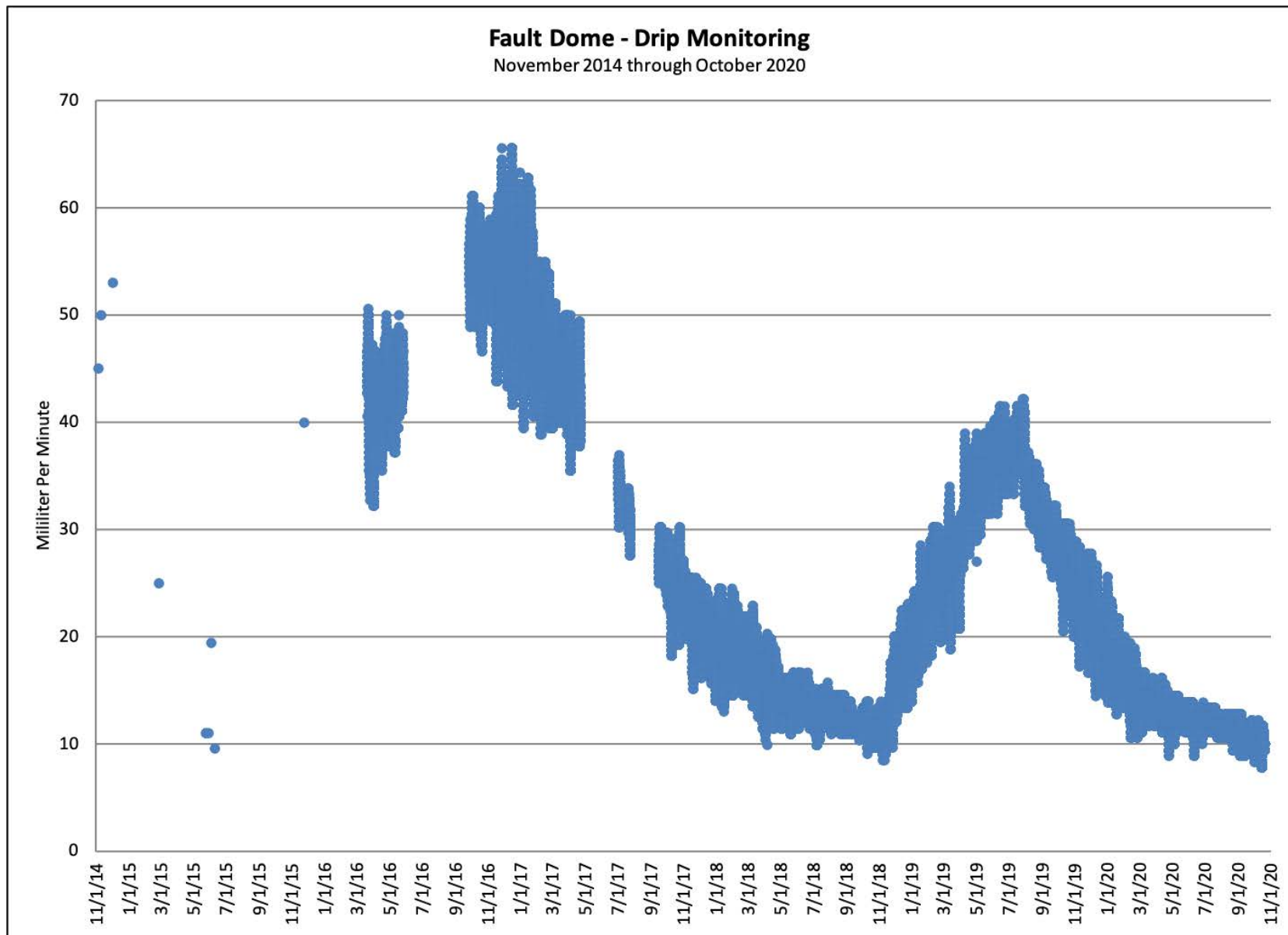
Mean -9.72 – Minimum 0.00 – Maximum -34.99

Good data collected all year.

The station is currently deployed and operational. The current configuration funnels a two foot diameter area of drips through an Onset RG3 tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB







Drip Pit

Discrete Cave Drip

This site is the most active single dripping speleothem in the cave. It is a prominent stalactite, the tip of which is at an elevation of 663.6 ft msl. This is within the Dolomitic Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

35,130 drip rate measurements during 2020.

Mean 72.34 – Minimum 0.00 – Maximum 113.05

116,557 drip rate measurements since October 2014.

Mean 59.76 – Minimum – 0.00 – Maximum 113.05

Deviation of 2020 drip rates from complete record:

Mean -12.58 – Minimum 0.00 – Maximum 0.00

Good data collected all year.

This station is currently deployed and operational. Current configuration funnels the water from the single stalactite through a RainWise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB. The RainWise tipper is suspended from the ceiling, with a bucket hanging below it which collects just over 2 liters of water before pouring over. There is an isco 6712 Autosampler with a 5 ft suction line for drawing samples from the bucket. To keep it safer during recharge events the autosampler is suspended from the ceiling utilizing a pully system which allows it to be lowered for sample retrieval.

2020 Flow Anomalies

Historically this stalactite has always been known to constantly drip with a significant flow. In addition to historical observations, we have 116,557 drip rate measurements going back to October of 2014 and they show a constant flow up until just before midnight (23:45) on October 10, 2019 when 0 drips were recorded flowing from the stalactite for the first time ever. This was the beginning of about 19 hours of flow which was anomalously inconsistent and lower than the preceding days average,

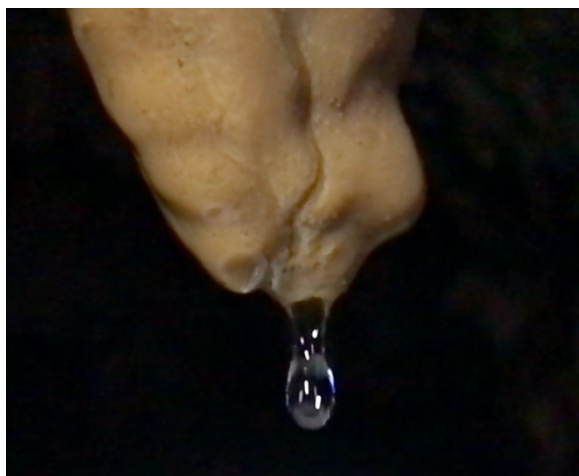
followed by 24 hours of no flow at all. Before returning to an average flow regime the stalactite spent another 22 hours flowing at a rate that was anomalously inconsistent and lower than the preceding days average, with this 22 hour period being punctuated by a half-dozen spells of completely ceasing flow. At 15:30 on October 13 flow resumed nearly consistent and average flow, although the flow did again briefly cease once on October 14 and twice on October 17. There were also brief anomalous reductions in flow rate on October 8, 16, 19, 21, 28, November 23, and December 5, of 2019.

Novel Sediment

Upon entering the Drip Pit on May 22, 2020, it was observed that the Drip Pit Stalactite was covered in what appeared to be a fine sediment. This sediment was so fine that it apparently was able to flow freely throughout the entire drip monitoring apparatus, as inspection revealed only a trace within and no accumulation except in the hanging sample collection bucket.



Before the May 22, 2020 observation nothing of this sort had ever before been noticed on this formation during any of the authors 170 prior work trips into Flint Ridge Cave. This novel sediment has been visibly present on all subsequent trips.



The tip of the Drip Pit Stalactite on the left as it has always appeared versus on the right is how it has appeared since May 22, 2020.



The Drip Pit Stalactite on the left is how it has always appeared versus on the right is how it has appeared since May 22, 2020.

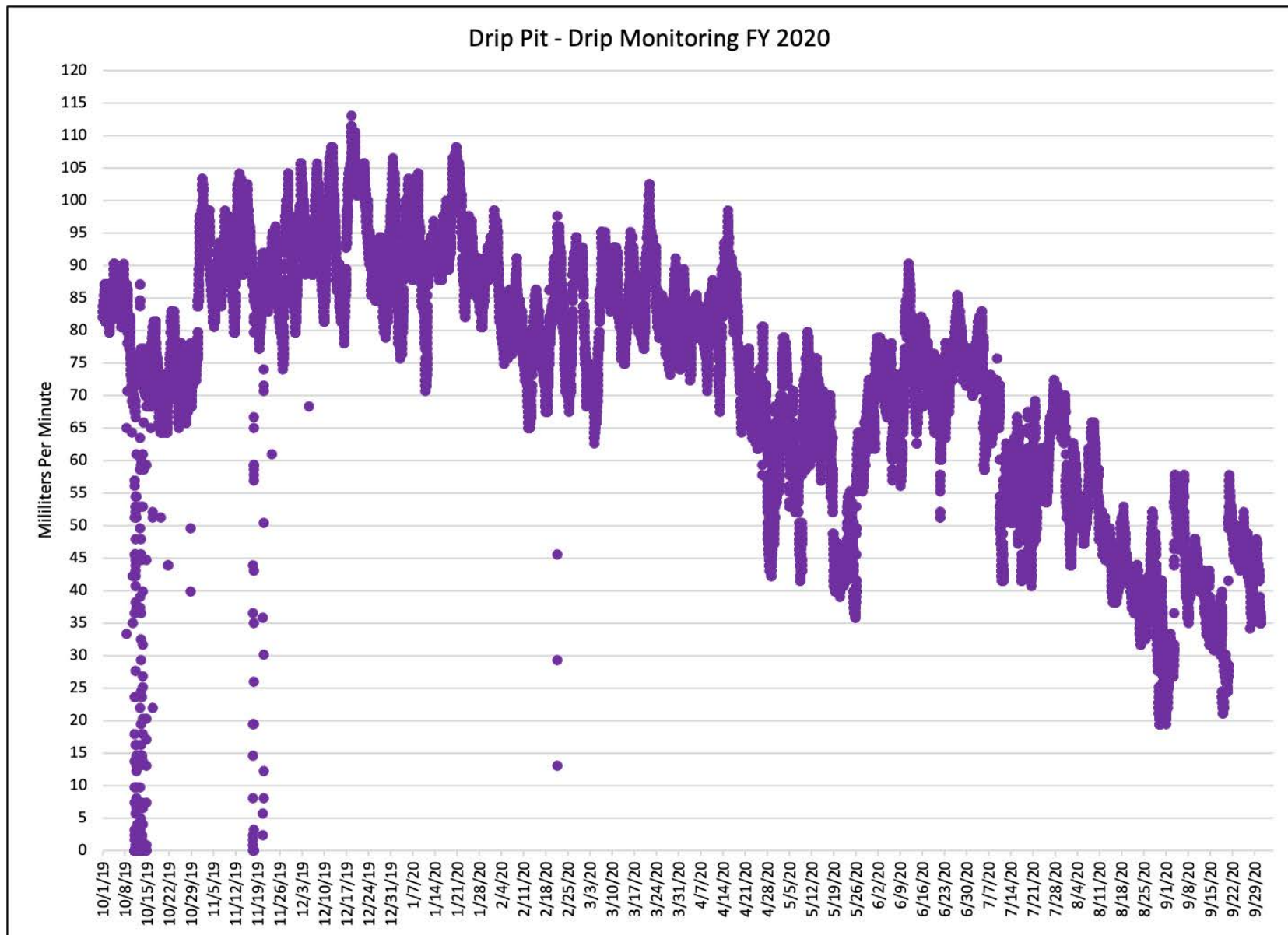
(Left picture is from July 20, 2017 and right picture is from June 2, 2020)

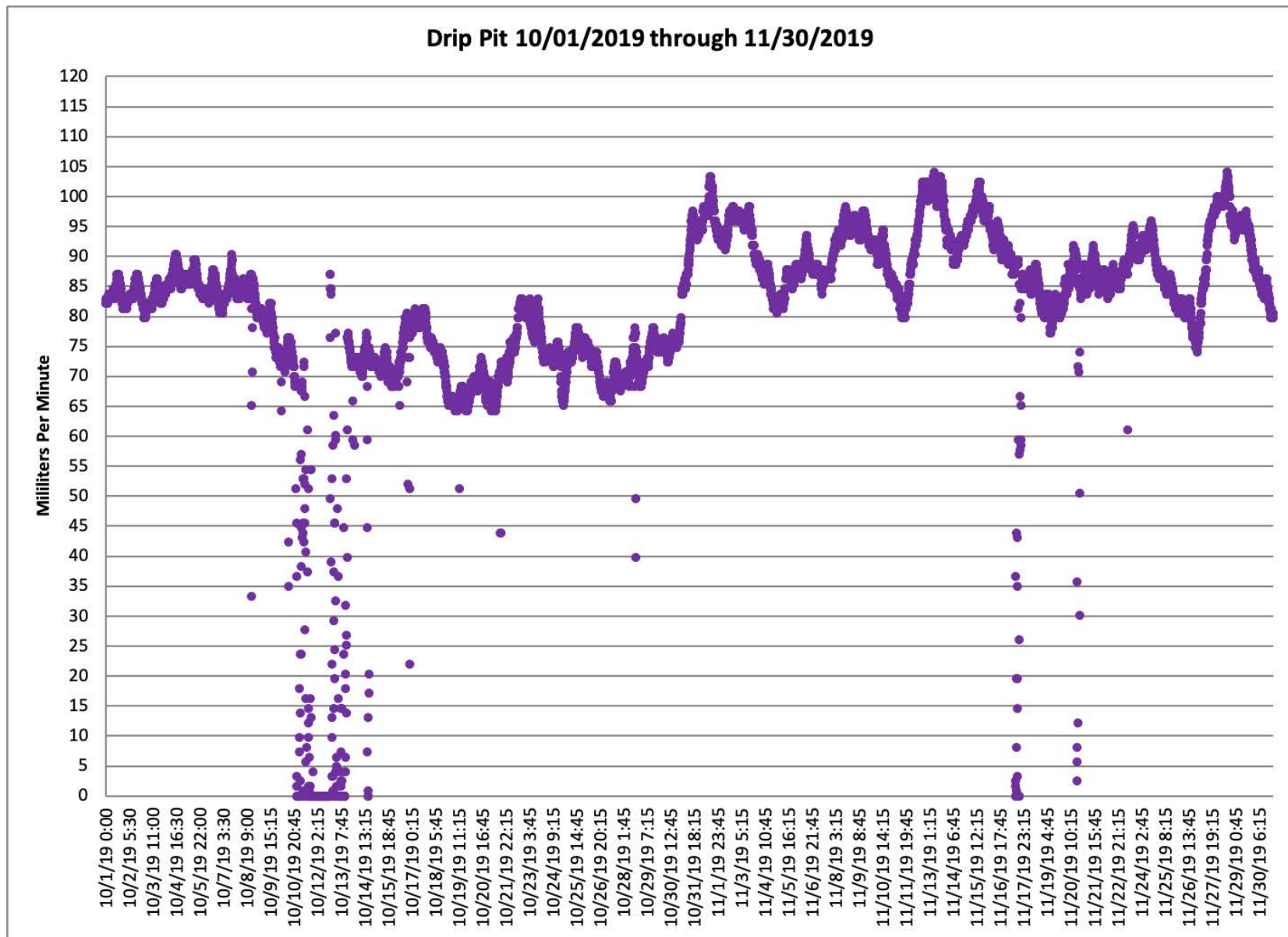


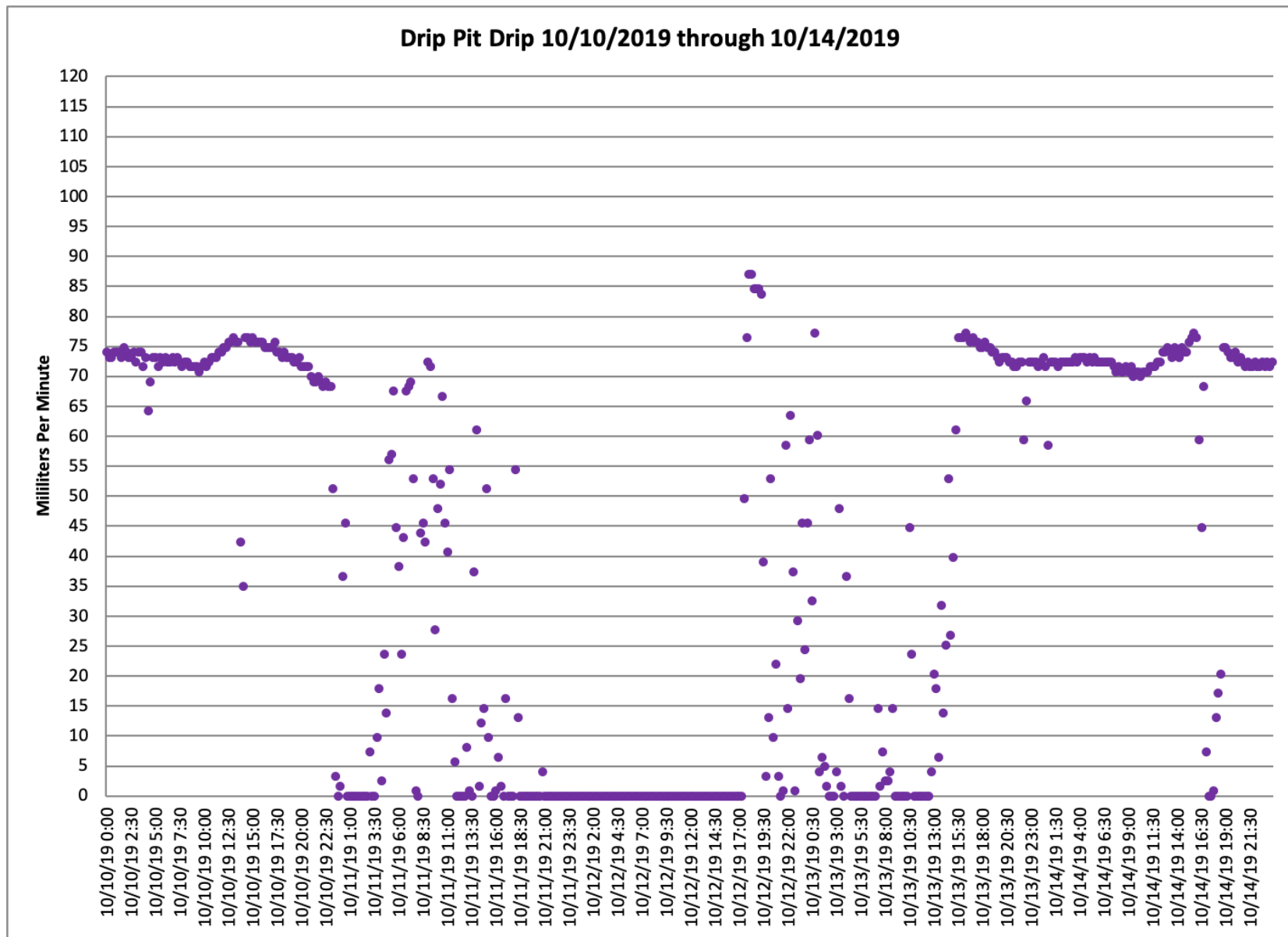
The Drip Pit Stalactite drips into a funnel, as shown in the picture on the right. As seen on the left, this funnel flows into a tipper that is suspended from the ceiling with a bucket hanging below it which collects just over 2 liters of water before pouring out/over through the hole seen in the picture. There is also an autosampler suspended from the ceiling, with a suction line for drawing samples from the bucket.

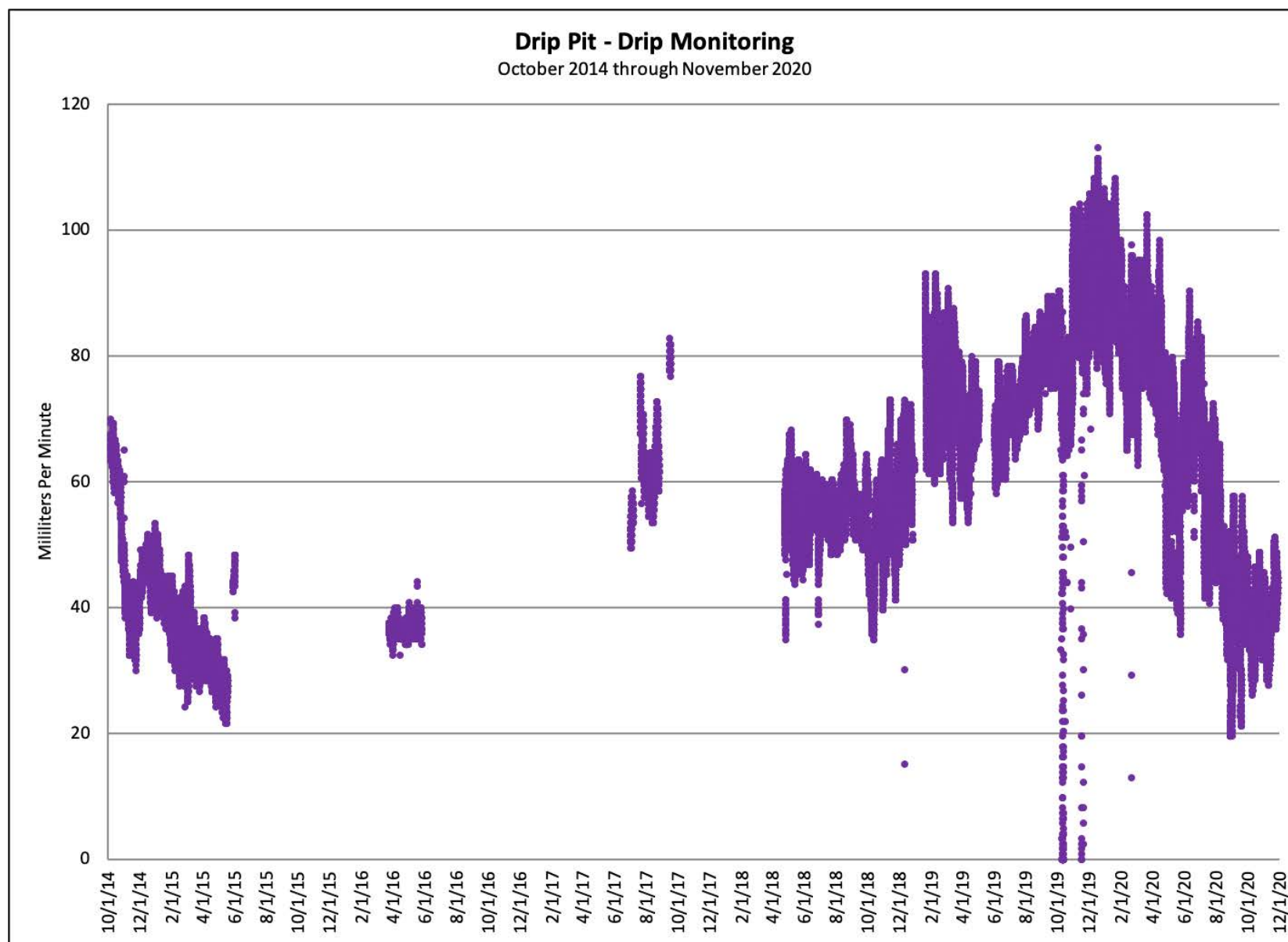


Cave Specialist Justin Shaw collecting a grab sample from the Drip Pit.









Culvert Crawl Update



Cave Specialist Kevin Walsh negotiating Culvert Crawl.

Historic Setting

Culvert Crawl is a primary passage within Flint Ridge Cave. It is proven to be highly hydrogeologically interconnected to the karst landscape. This was established by successful traces from 5 nearby karst features. It contains a perennial cave stream at an elevation descending from 717.1 ft msl to 716.7 ft msl. This cave stream ranges from just a trickle during drought conditions to completely inundating the passage during recharge events.

At the upstream end of this passage is Culvert Crawl Upper Pool, which is a perennial cave pool at an elevation of 717.1 ft msl. At the downstream end of this passage is Culvert Crawl Lower Pool at an elevation of 716.7 ft msl.

Culvert Crawl Upper Pool is an 8 in to 18 in deep cave pool with a bedrock floor strewn with loose limestone and chert cobbles, and since September of 2017 there has also been a fine silt-like sediment deposit. There is a gravel bar of limestone and chert cobbles stabilized by red clay, which separates Culvert Crawl Upper Pool from Culvert Crawl (the passage).

Past the Culvert Crawl Upper Pool is the namesake passage, Culvert Crawl, which at first is a cave stream about two feet wide and two to four inches deep. It had always been bare exposed bedrock with a few occasional cobbles, however since September of 2017 it now has a ~.25 in to ~.50 in deposit of fine silt-like sediment. Beyond this the passage makes a zig-zag and then the cave stream is characterized as being 4 to 9 inches wide and 4 to 6 inches deep, with both walls tapered creating a V shaped channel. This V channel is cut into limestone bedrock. Over the past year this channel has seen a ~.5 in accumulation of the fine silt-like sediment. Culvert Crawl Lower Pool is the same channel of culvert crawl, being impounded behind a high point in the bedrock floor and a mass of rocks and red clay.



The novel silt-like sediment, which was first observed September 16, 2017, persists within Culvert Crawl, as seen in this picture from June 4, 2020.

New Novel Observation

On June 3, 2019, while attending to regular maintenance of drip monitoring stations, Cave Specialist Justin Shaw made a novel observation in Culvert Crawl.

There was a novel substance that appeared as tiny black filamentous objects, mostly attached to cobbles, and only being present underwater. The novel filamentous matter was composed of thousands of tiny black filaments about .7mm in diameter (diameter of a mechanical pencil lead) and about .25 in long. The greatest concentrations were on cobbles, however it also appeared, at a much lesser concentration, attached to the exposed bedrock. There was very little attached to organic detritus, while none was present on the fine silt-like deposit. As we proceeded down Culvert Crawl the abundance of the novel substance decreased with distance from Culvert Crawl Upper Pool. It was present all the way to Culvert Crawl Lower Pool. It was observed nowhere else in the cave.

On July 16, 2019 the novel substance persisted, and it had increased in quantity while also now including new forms and more colors. The form still included the black filamentous matter, and now also had small masses with a blob-like nebulous form. These came in black, black with bluish shimmer, grey, yellow, and some whitish to nearly-translucent. Some of the whitish to nearly translucent matter also contained white dendritic vein like structures. All of this was occurring under water. As with the prior observation, the abundance of the novel substance decreased with distance from Culvert Crawl Upper Pool. It was present all the way to Culvert Crawl Lower Pool. It was observed nowhere else in the cave.

On subsequent trips the prevalence of the novel substance was noticed to be decreasing. On an October 1, 2019 trip it was noted to only be visible in trace amounts. On all subsequent trips the substance persisted in various minute amounts until October 15, 2020, when it returned to being as plentiful as it had been during its first observations.



June 3, 2019



June 3, 2019



June 3, 2019



June 3, 2019



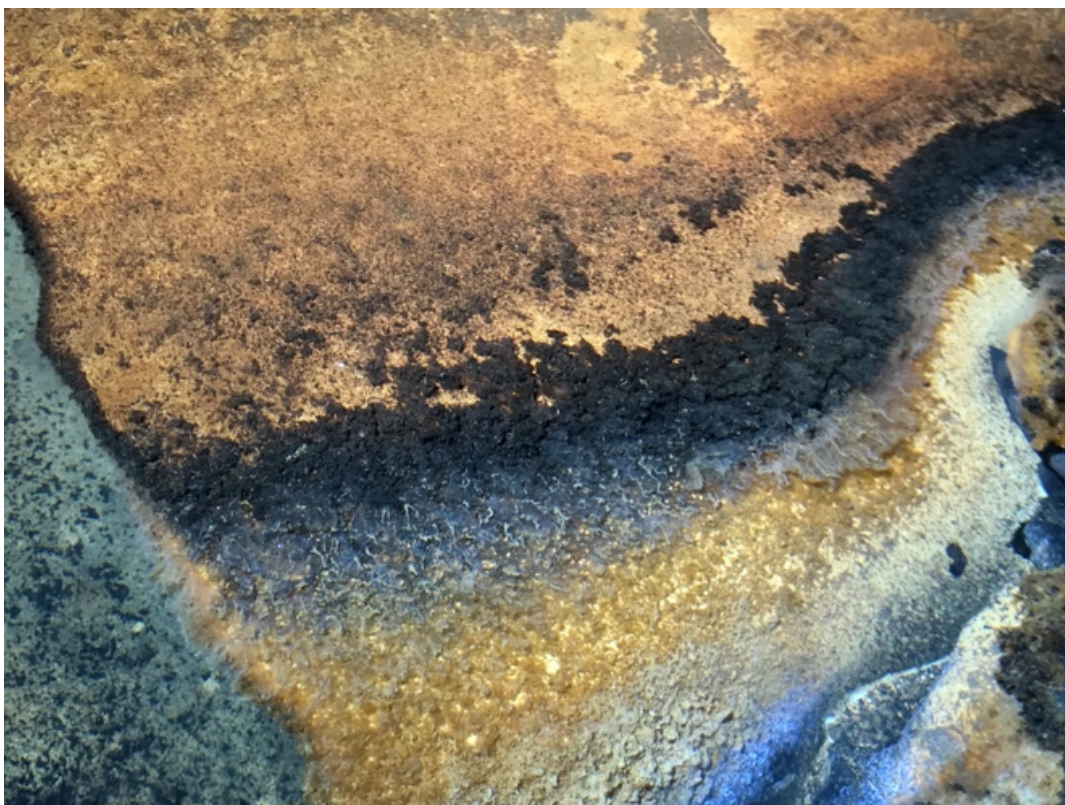
June 3, 2019



July 16, 2020



July 16, 2019



July 16, 2019



July 16, 2019



October 15, 2020

Tabor Crevice Cave

Tabor Crevice Cave is located on a remote part of the Tabor Water Quality Management Area. The cave was dug into by members of the City of Austin Cave Team during July of 2014.

Hydrogeologically it is part of the Flint Ridge System. Though a human sized connection has yet to be made, tracer studies have revealed interconnected flow paths within the vadose zone.

During FY 2020 no automated drip rate measurements were recorded. This was due to two datalogger failures for undermined reasons.

Although there was no obvious moisture penetration or other foreign substance within the datalogger, it is interesting to note that this particular datalogger was, and is typically, found covered in water droplets with some being tented in color so as to visually appear as if colonized by actinobacteria (which is found thriving elsewhere within Tabor Crevice Cave).



An Onset HOBOTemp USB Micro Station Data Logger H21-USB in Tabor Crevice Cave with water droplets on it, some of which appear the same as the colonies of actinobacteria found elsewhere within this and other Central Texas caves.

Tabor Crevise Cave

Travis County Texas

Traverse Length 825 ft
Maximum Depth Below Datum 61ft

Plan View with Projected Cross Sections
Full Profile Projected at 30°

Cartography by Justin Shaw
June 2018
Magnetic Declination at Publication +3.8°

DistoX2 Survey by

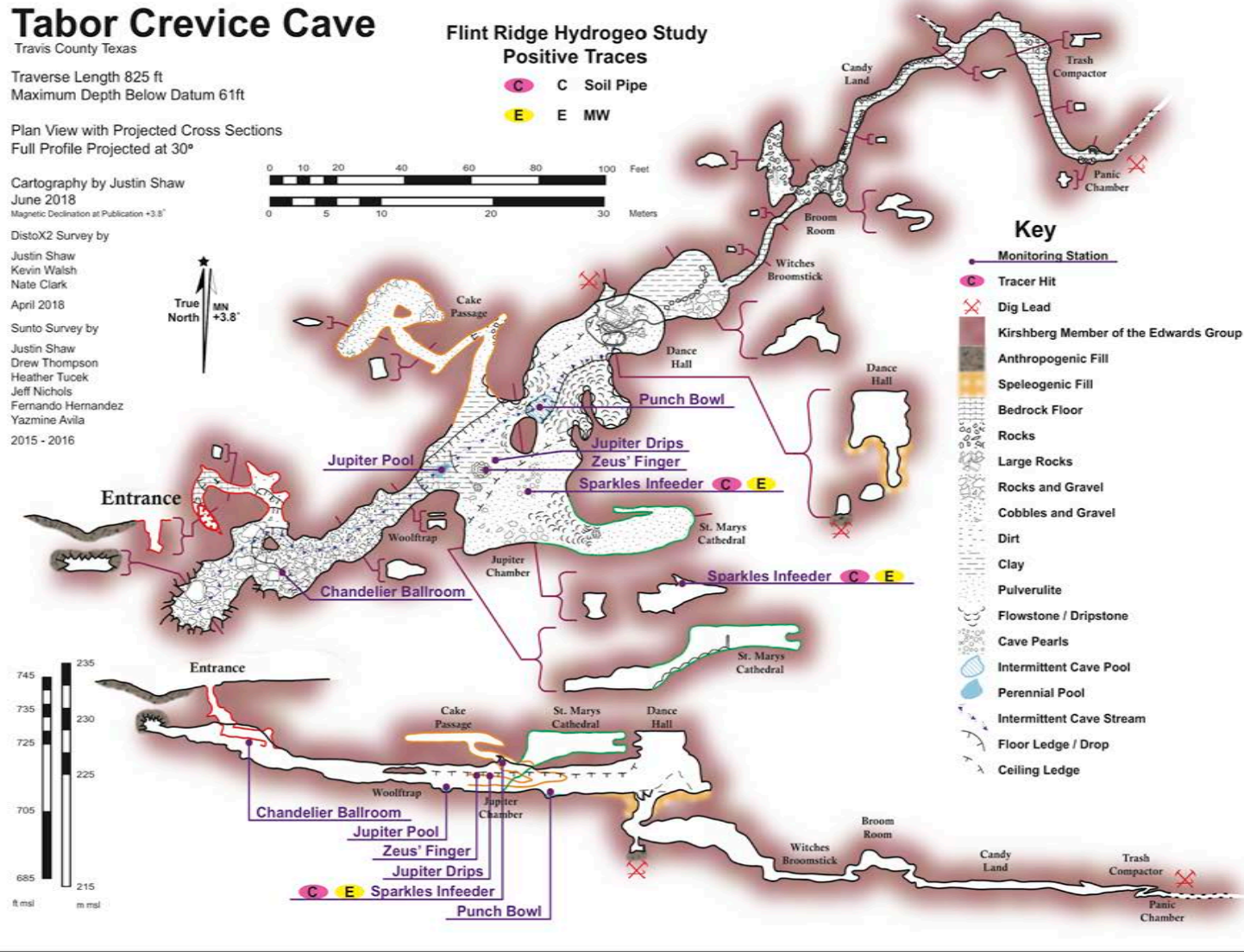
Justin Shaw
Kevin Walsh
Nate Clark
April 2018

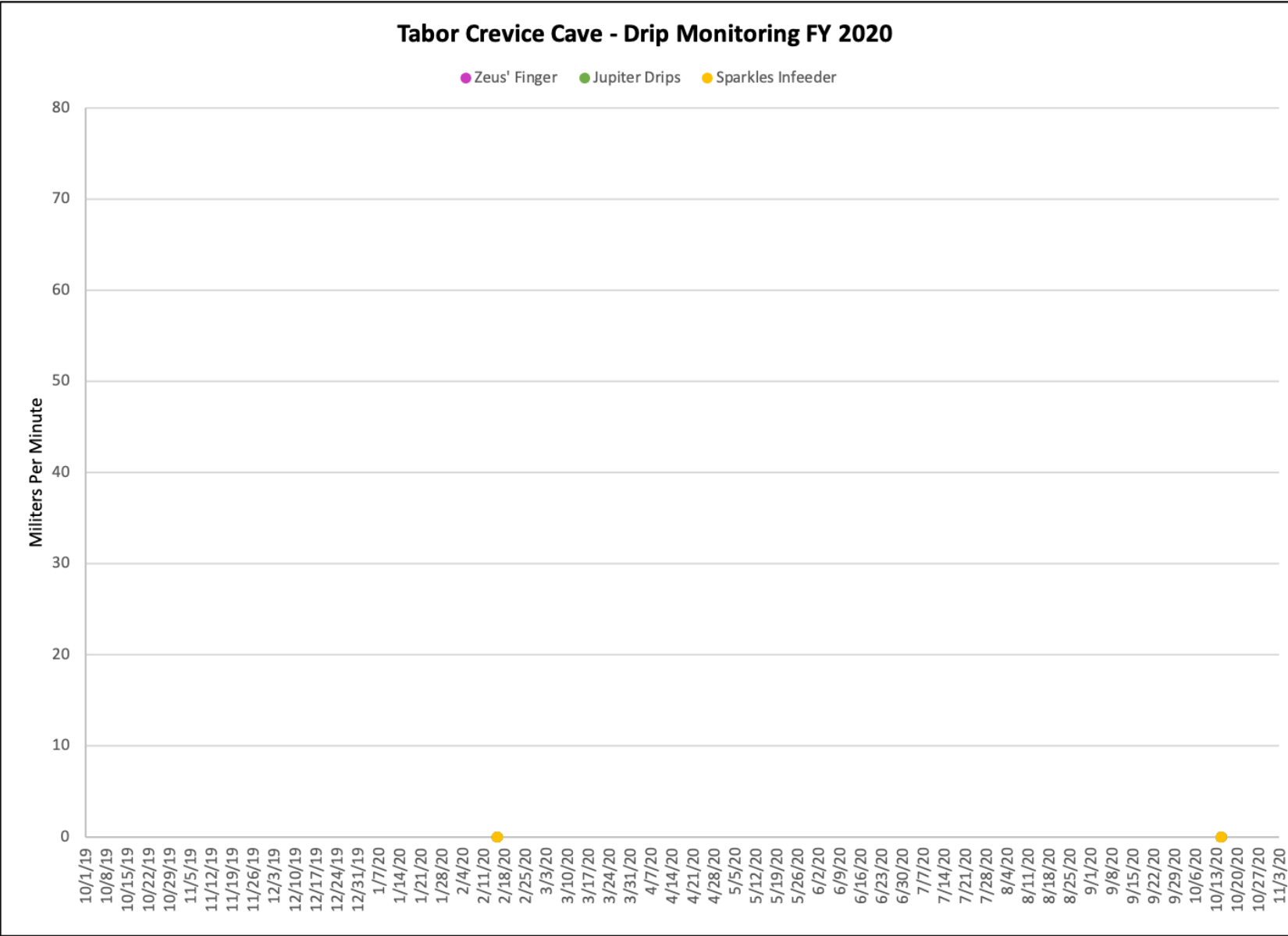
Sunto Survey by

Justin Shaw
Drew Thompson
Heather Tucek
Jeff Nichols
Fernando Hernandez
Yazmine Avila
2015 - 2016

Flint Ridge Hydrogeo Study Positive Traces

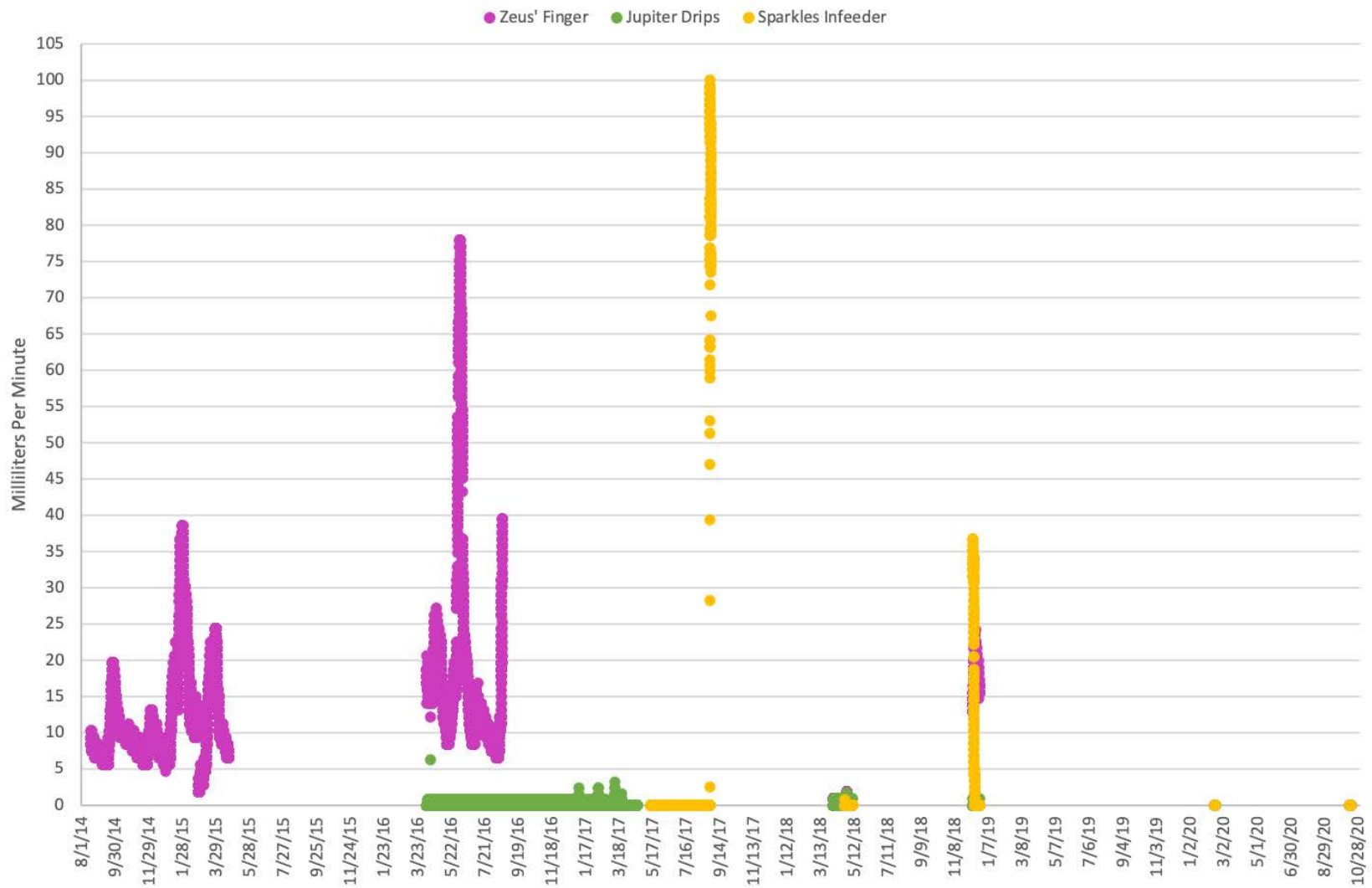
C C Soil Pipe
E E MW





Tabor Crevice Cave - Drip Monitoring

August 2014 through October 2020



Zeus' Finger

Discrete Cave Drip

This site has historically been the most active drip inside Tabor Crevice Cave, with a mean flow rate of 13.30 milliliters per minute. It is a stalactite located within the Kirschberg Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

8 drip rate measurements during 2020.

Mean 0.00 – Minimum 0.00 – Maximum 0.00

39,085 drip rate measurements since August 2014.

Mean 13.30 – Minimum – 0.00 – Maximum 77.96

Deviation of 2020 drip rates from complete record:

Mean **-13.30** – Minimum 0.00 – Maximum **-77.96**

Drip rate manually recorded on February 15th, 2020 and October 14th, 2020.

Datalogger failures were due to undetermined causes. All stations in Tabor Crevice Cave are connected to the same datalogger. Datalogger was replaced on February 15, 2020 and October 14, 2020.

To facilitate FY 2020 monitoring the cave was accessed twice and during both trips Zeus' Finger was observed dry, which is anomalous. While this stations complete drip monitoring record (39,085 drip rate measurements since August 2015) shows some 15-minute intervals of zero tips during April of 2018, the drip was never dry and as such the zero records can result in a deceptive interpretation and calculated statistical mean of 0.00 milliliters per minute. If during the period of lowest flow the drip rate is calculated hourly you get a true minimum flow rate of 0.23 milliliters per minute.

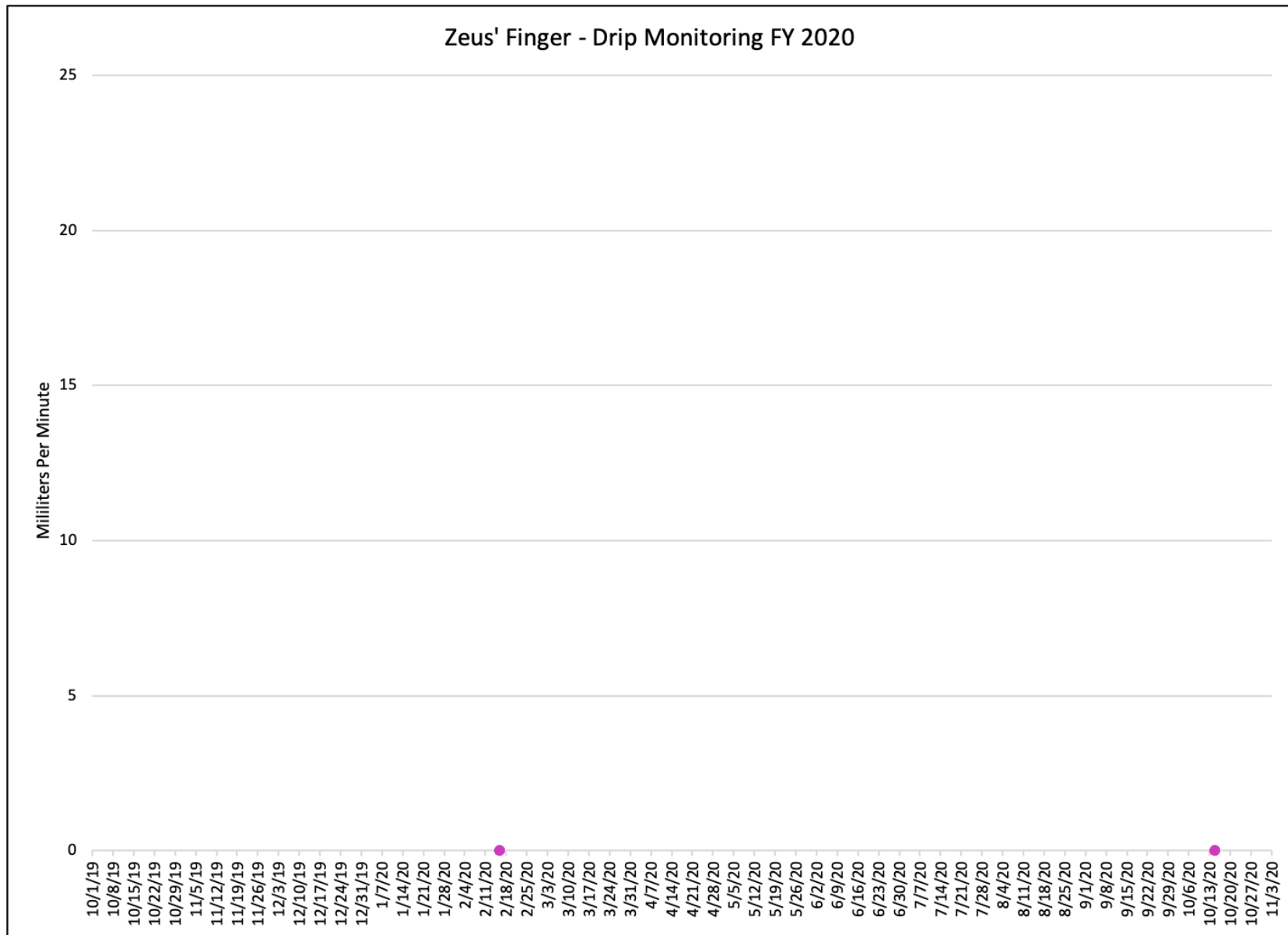
Station is currently deployed and operational. The current configuration is a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB

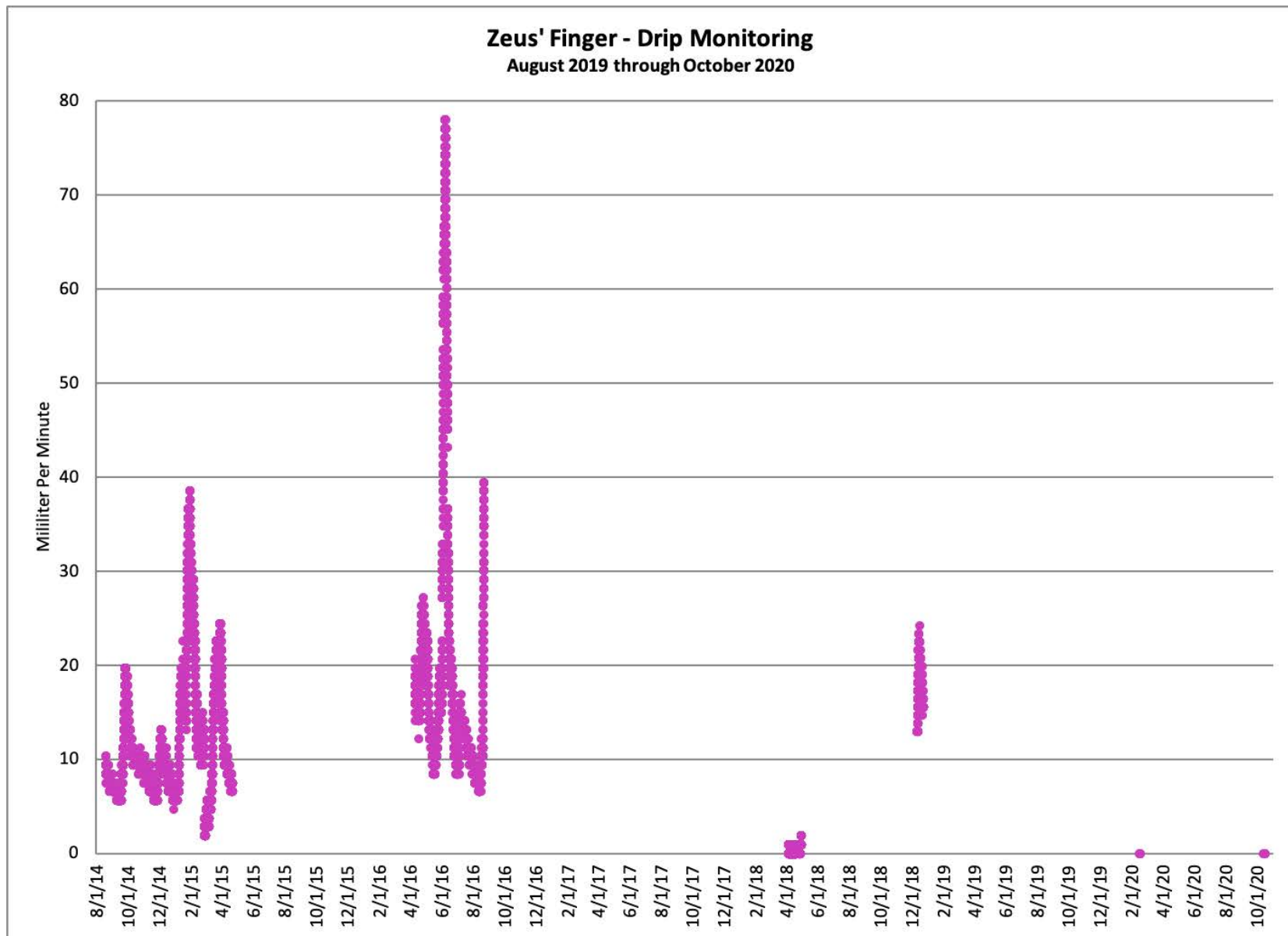


Current setup of Zeus' Finger monitoring station. The large rocks are necessary to keep playful racoons from destroying the equipment.



A rapid succession of cave drips, flowing at a rate of 17.9 milliliters per minute, strike dripstone formations after issuing from Zeus' Finger in this photo from May 30, 2015.





Jupiter Drips

Discrete Cave Drip

This site is a collection of drips from tubular stalactites located within the Kirschberg Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

8 drip rate measurements during 2020.

Mean 0.00 – Minimum 0.00 – Maximum 0.00

39,924 drip rate measurements since April 2016.

Mean 0.01 – Minimum – 0.00 – Maximum 6.35

Deviation of 2020 drip rates from complete record:

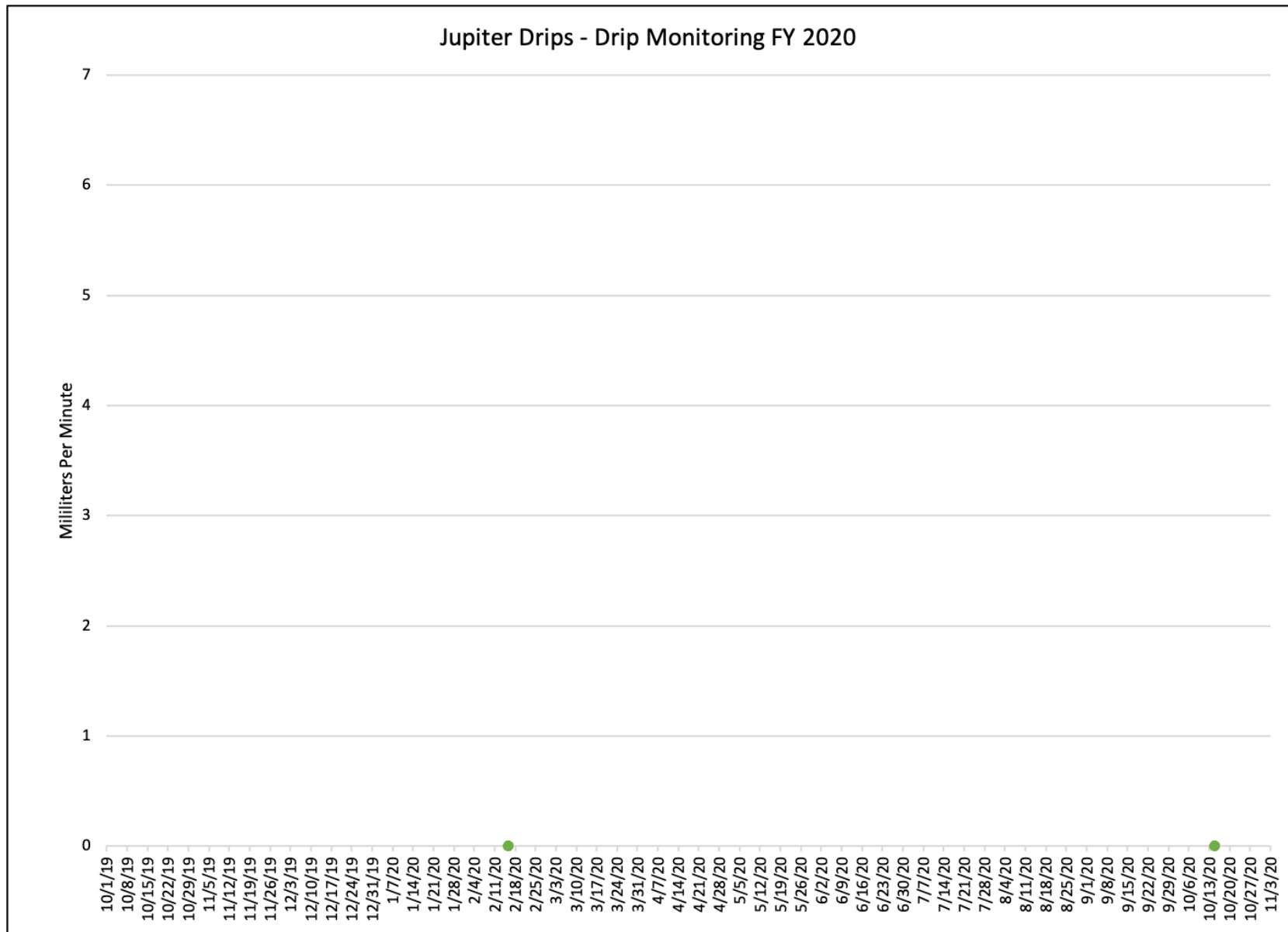
Mean -0.01 – Minimum 0.00 – Maximum -6.35

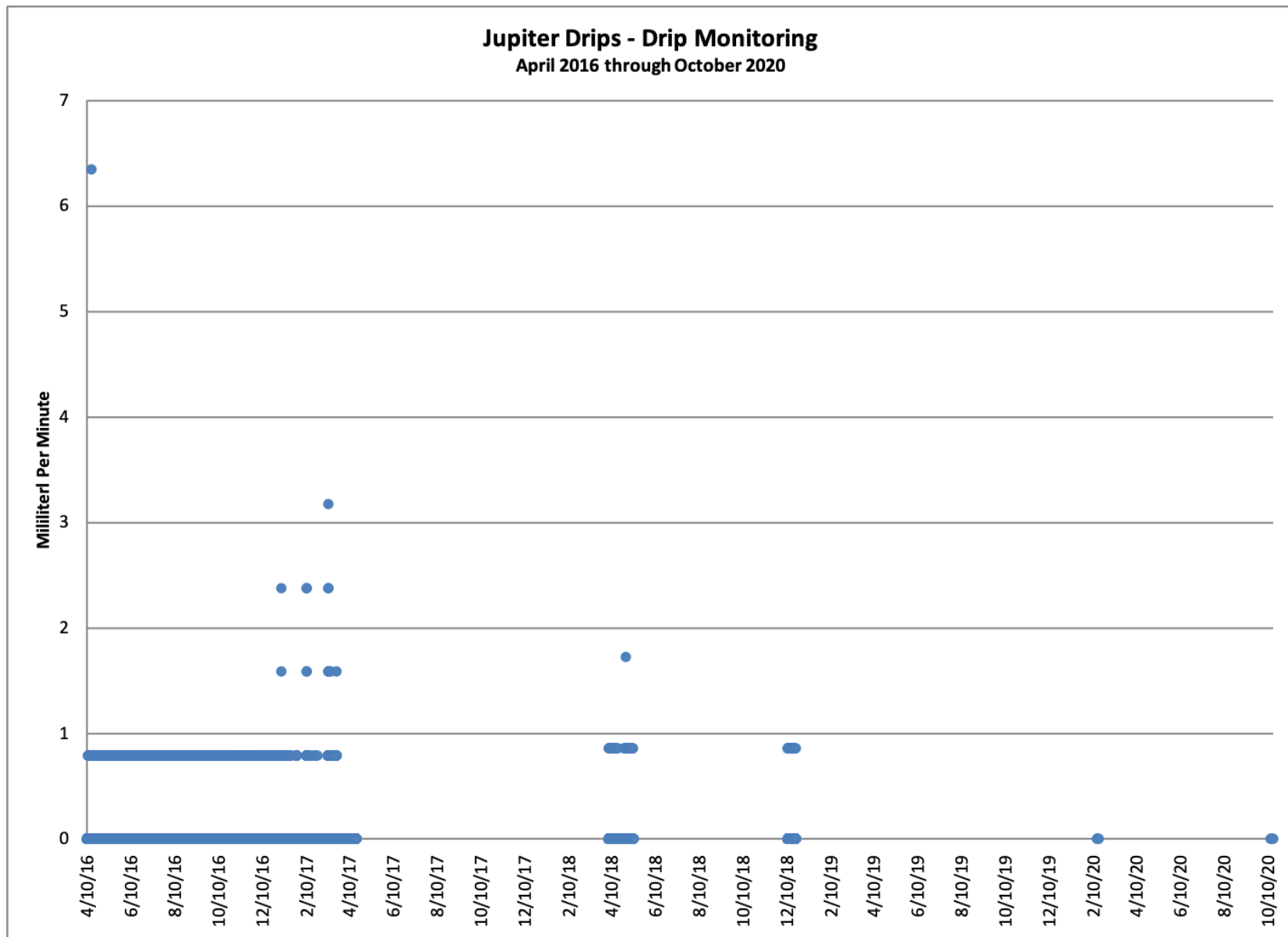
Drip rate manually recorded on February 15th, 2020 and October 14th, 2020.

Datalogger failures were due to undetermined causes. All stations in Tabor Crevice Cave are connected to the same datalogger. Datalogger was replaced on February 15th, 2020 and October 14th, 2020.

Station is currently deployed and operational. The current configuration consists of a small plastic sheet tarp funneling multiple drips through a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB







Sparkles Infeeder

Infeeder

This site is an infeeder and is within the Kirschberg Member of the Edwards Group. The site is decorated with brilliant white sparkling stalactites and below it is an area of microtravertine dams and the only known occurrence of cave pearls in Travis Co. This is a normally dry formation area and only flows for a short time after rain events.

Statistical volumes below are in milliliters per minute.

8 drip rate measurements during 2020.

Mean 0.00 – Minimum 0.00 – Maximum 0.00

39,924 drip rate measurements since May 2017.

Mean 1.73 – Minimum – 0.00 – Maximum 100.00

Deviation of 2020 drip rates from complete record:

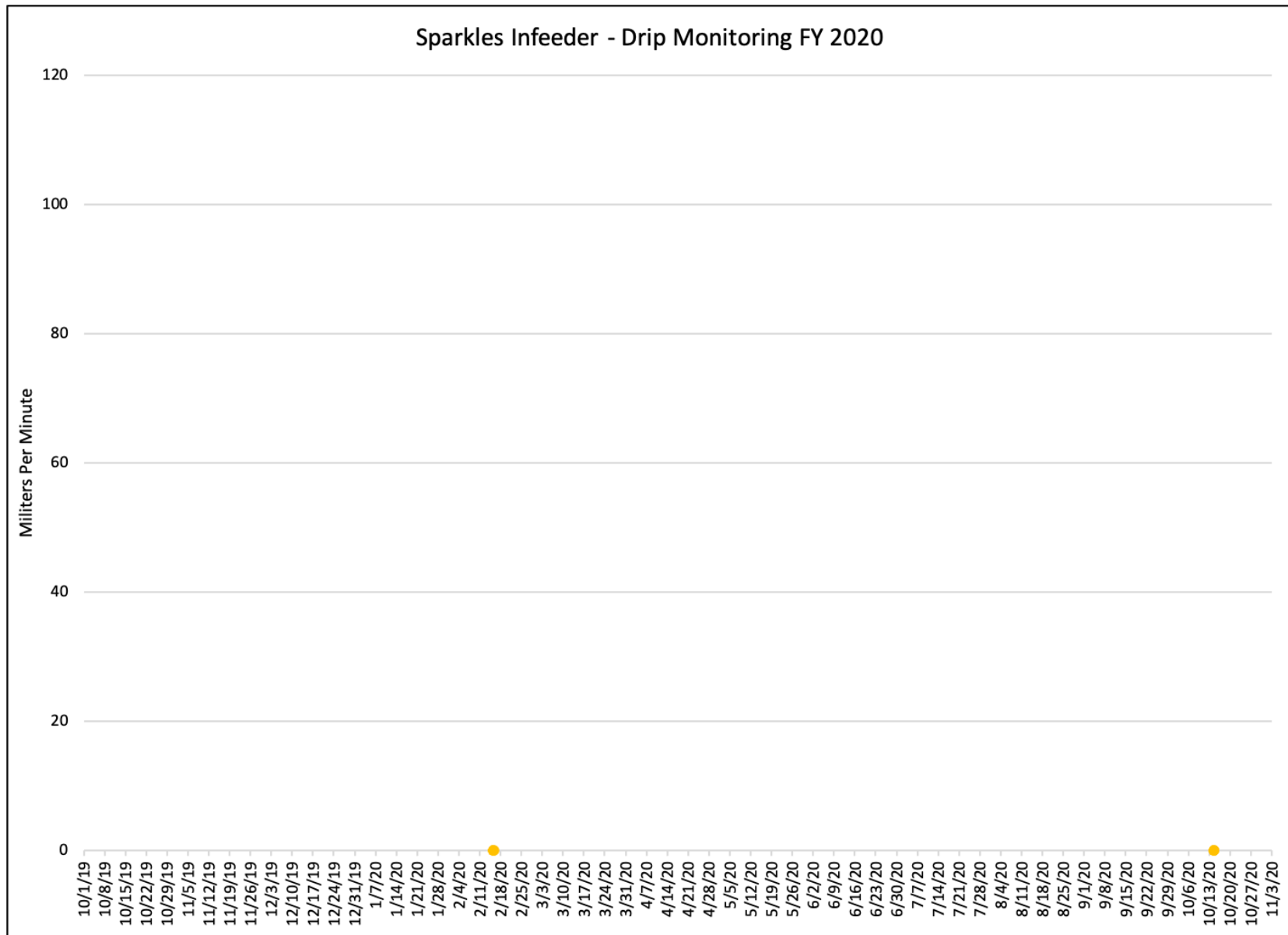
Mean -1.73 – Minimum 0.00 – Maximum -100.00

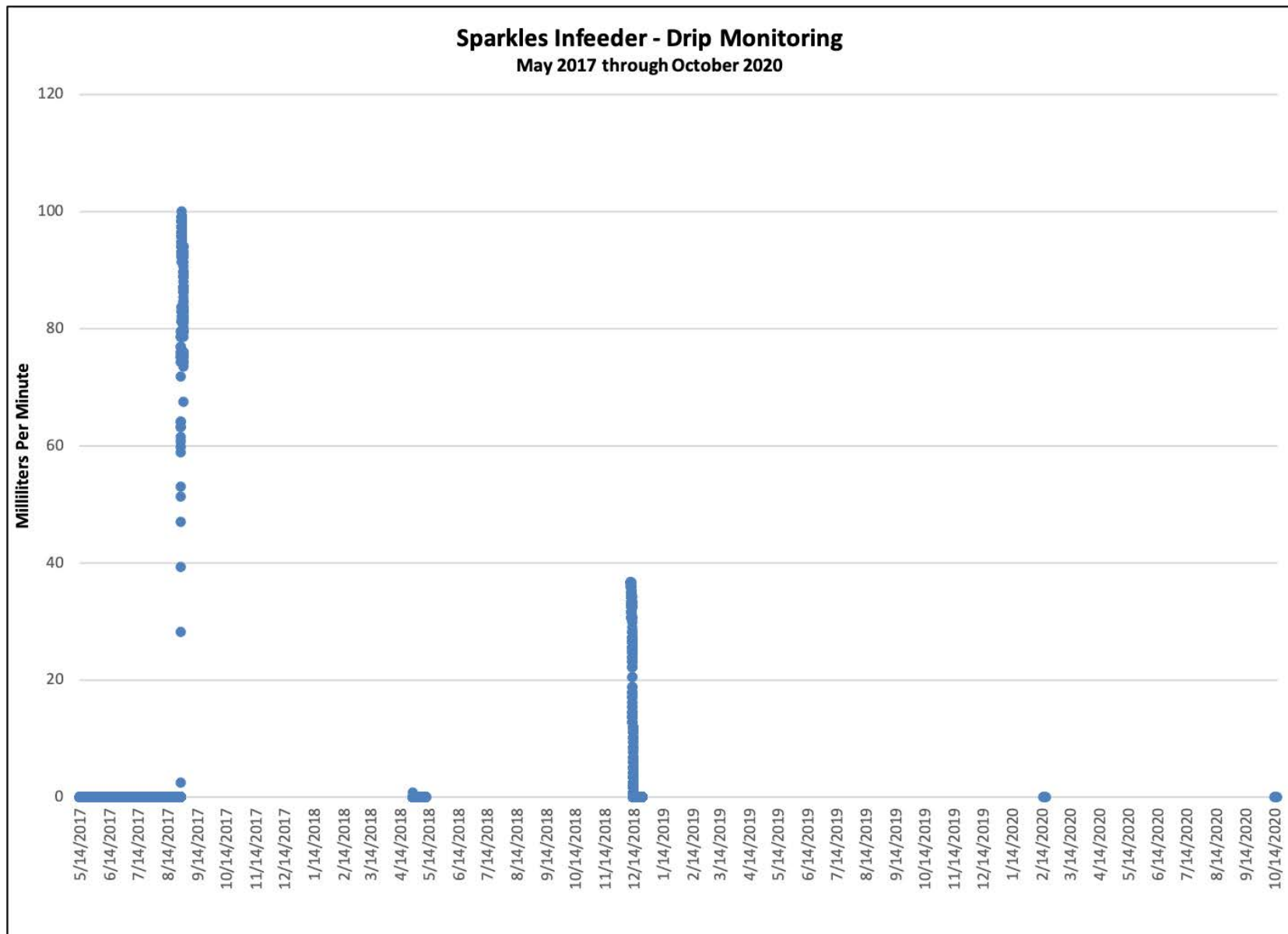
Drip rate manually recorded on February 15th, 2020 and October 14th, 2020.

Datalogger failures were due to undetermined causes. All stations in Tabor Crevice Cave are connected to the same datalogger. Datalogger was replaced on February 15th, 2020 and October 14th, 2020.

Station is currently deployed and operational. The current configuration is a Rain Wise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB







Dunvegan Dungeon Cave

Dunvegan Dungeon Cave is located on a remote part of the Tabor Water Quality Management Area. The cave was first located by neighbor Craig Turner and dug into by members of the Underground Texas Grotto during the fall of 1995.

Incidental Observation: Cave Entrance as a Wildlife Nexus

Following an observation, on December 14, 2018, of what appeared to be big cat scat and fresh large claw marks a game camera was placed at the entrance of the cave to investigate if a big cat was present.

So far, the game camera recorded the presence of a bobcat on three separate occasions, 2/6/2019, 2/12/2019, and 6/18/2019. We get many empty pictures, many of which were likely triggered by the wind; however, it is quite possible the cat can move fast enough to trigger the camera without getting photographed.

Also noteworthy was the number of different vertebrates which are depending on the resources presented by this cave and its open entrance. While some are the expected troglaphiles such as raccoon and porcupine, there are several species which are not usually associated with caves, though here they regularly visit the entrance to feed on emerging troglaxenes and troglaphiles; such as owls feeding on mice, and skunks feeding on harvestmen and/or cave crickets.

Considering this cave was found with an anthropogenically closed entrance, the restoration of the entrance to an open condition is a true environmental success story. Today the cave is a wildlife nexus, and the entrance is an observable hub.

What follows are a representative sample of wildlife captured on a game camera in the course of monitoring for the presence/absence of bobcat.





Bobcat just outside the entrance to Dunvegan Dungeon Cave.



Owl just outside the entrance to Dunvegan Dungeon Cave.



Owl appearing to hunt a mouse just outside the entrance to Dunvegan Dungeon Cave.



Armadillo just outside the entrance to Dunvegan Dungeon Cave.



Racoon just outside the entrance to Dunvegan Dungeon Cave.



Skunk just outside the entrance to Dunvegan Dungeon Cave.



Coyote just outside the entrance to Dunvegan Dungeon Cave.



Opossum just outside the entrance to Dunvegan Dungeon Cave.



Fox just outside the entrance to Dunvegan Dungeon Cave.



Deer just outside the entrance to Dunvegan Dungeon Cave.



One of a pair of birds which frequented the area just outside the entrance to Dunvegan Dungeon Cave.

Dunvegan Dungeon

Travis County Texas

Traverse Length 164 ft

Maximum Depth Below Datum 33 ft

Cartography by Justin Shaw

June 2018

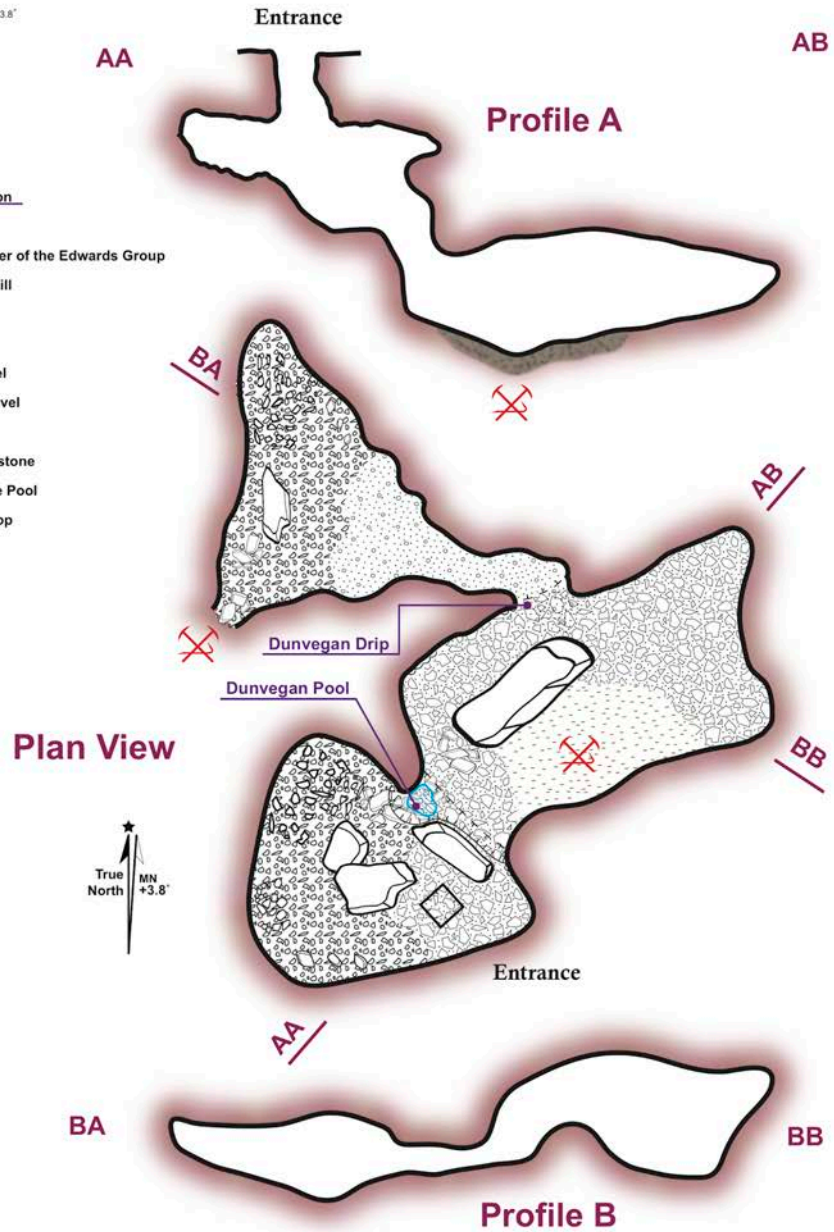
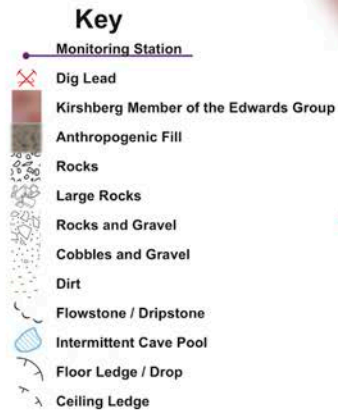
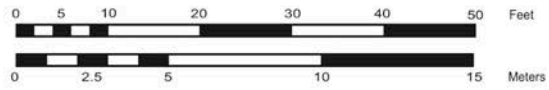
Magnetic Declination at Publication +3.8°

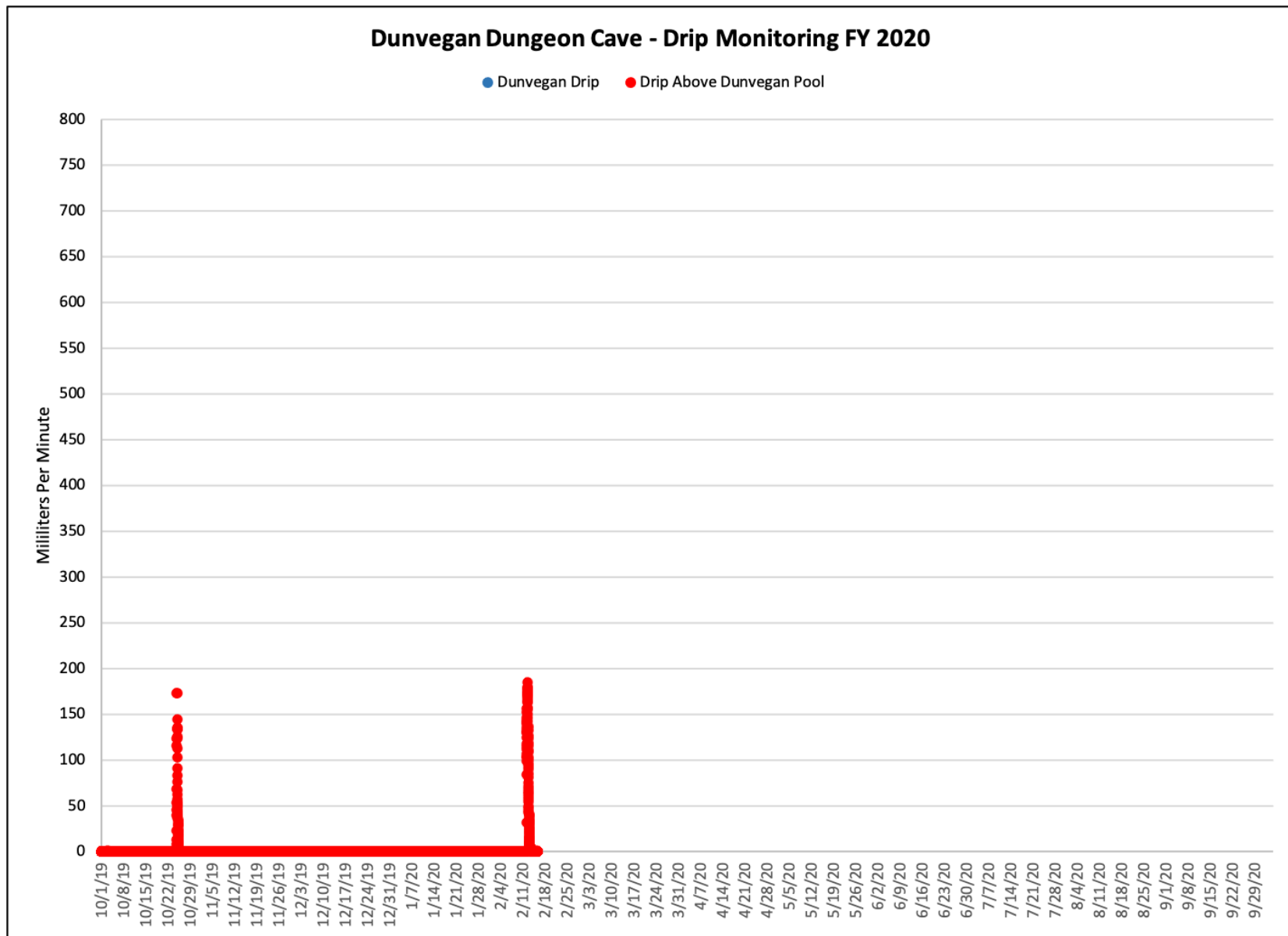
DistoX2 Survey by

Dylan Beeler

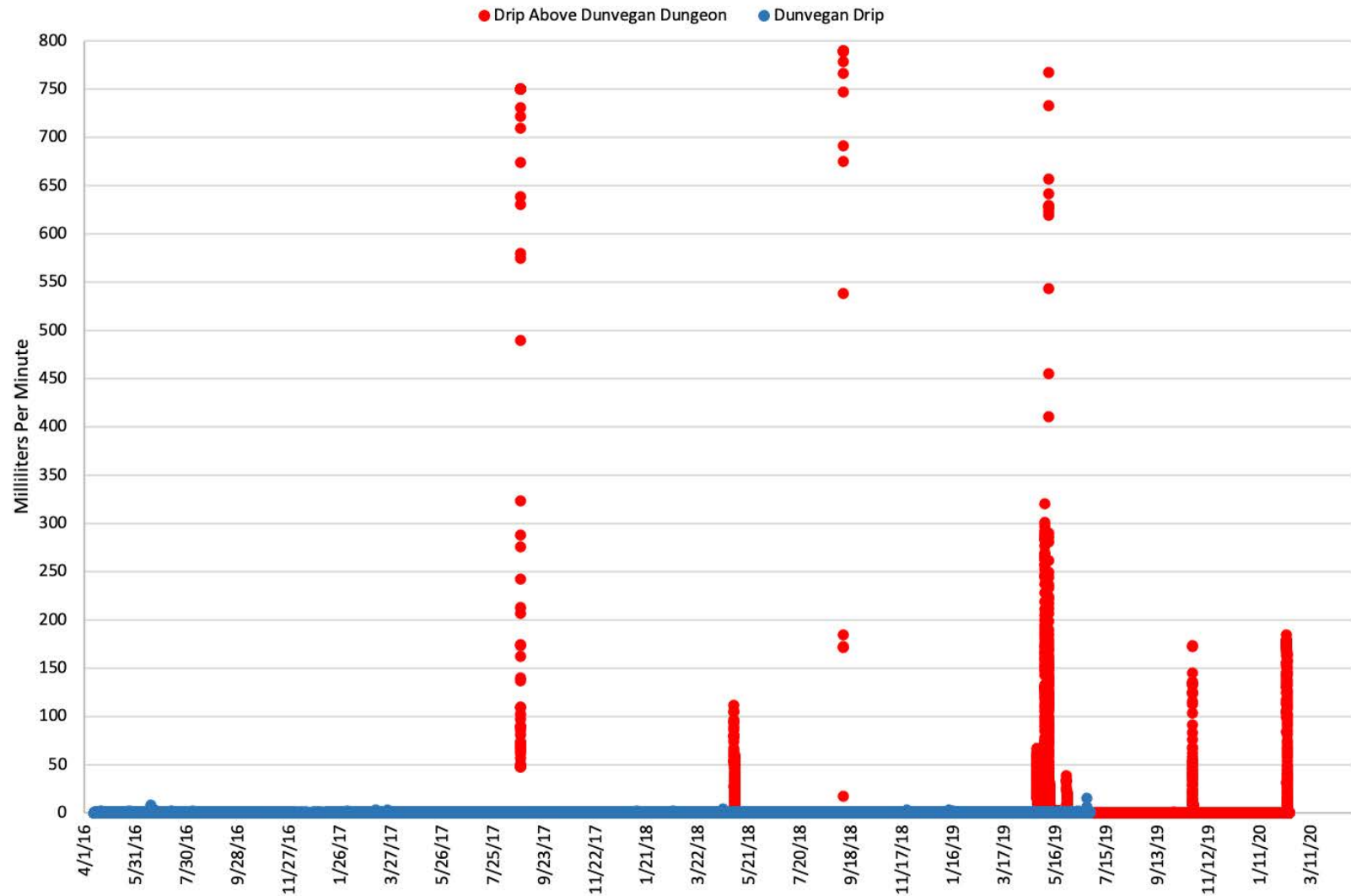
Mimi Alexander

Justin Shaw





Dunvegan Dungeon Cave - Drip Monitoring April 2016 through March 2020



Drip Above Dunvegan Pool

Discrete Cave Drip

This site is a discrete cave drip and is within the Kirschberg Member of the Edwards Group. This site holds the record for highest recorded flowrate of any monitored station, at 789.60 milliliters per minute recorded in September of 2018.

Statistical volumes below are in milliliters per minute.

13,225 drip rate measurements *retrieved* during 2020.

Mean 1.03 – Minimum 0.00 – Maximum 185.20

62,558 drip rate measurements since May 2017.

Mean 1.49 – Minimum – 0.00 – Maximum 789.60

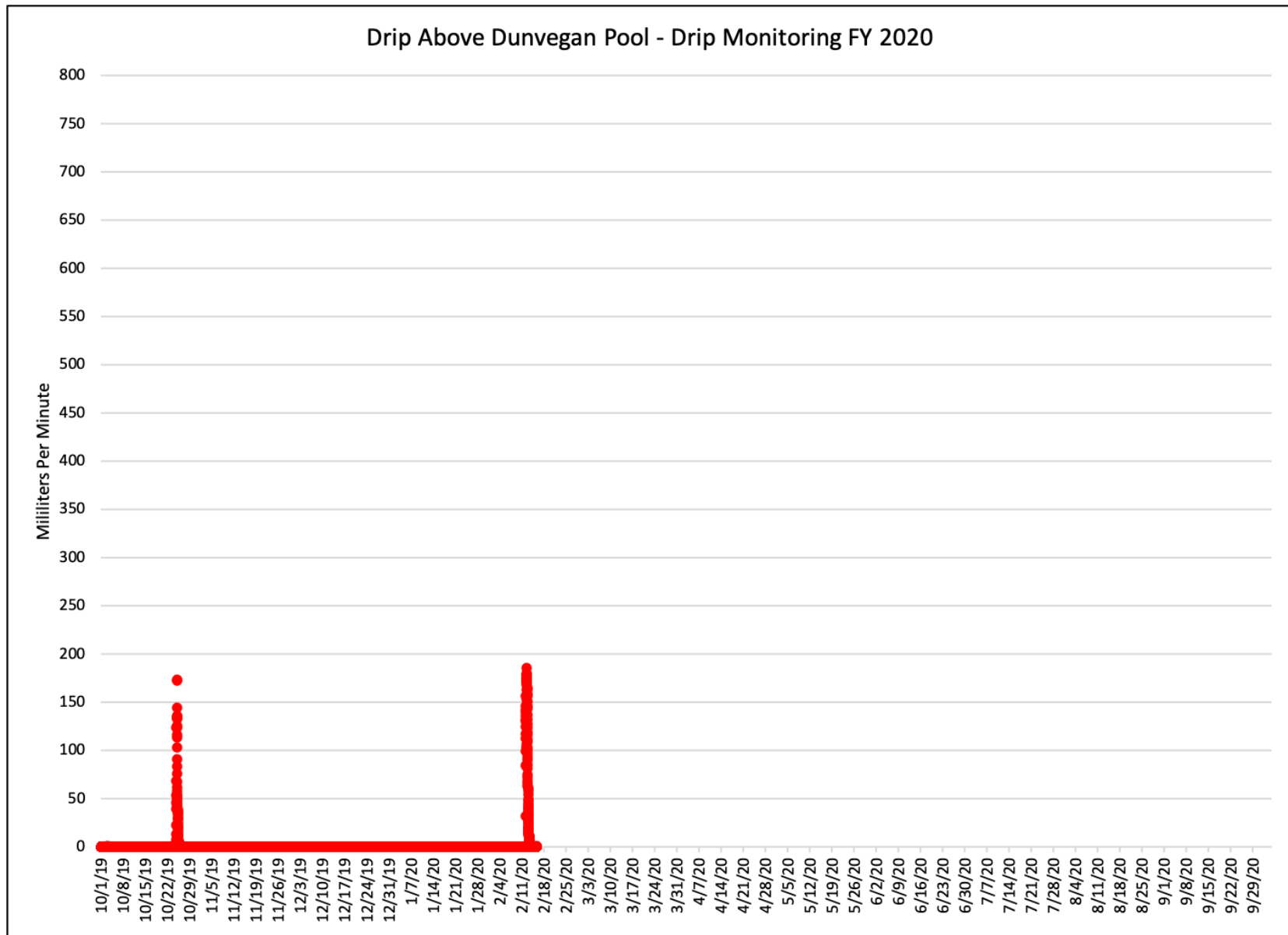
Deviation of 2020 drip rates from complete record:

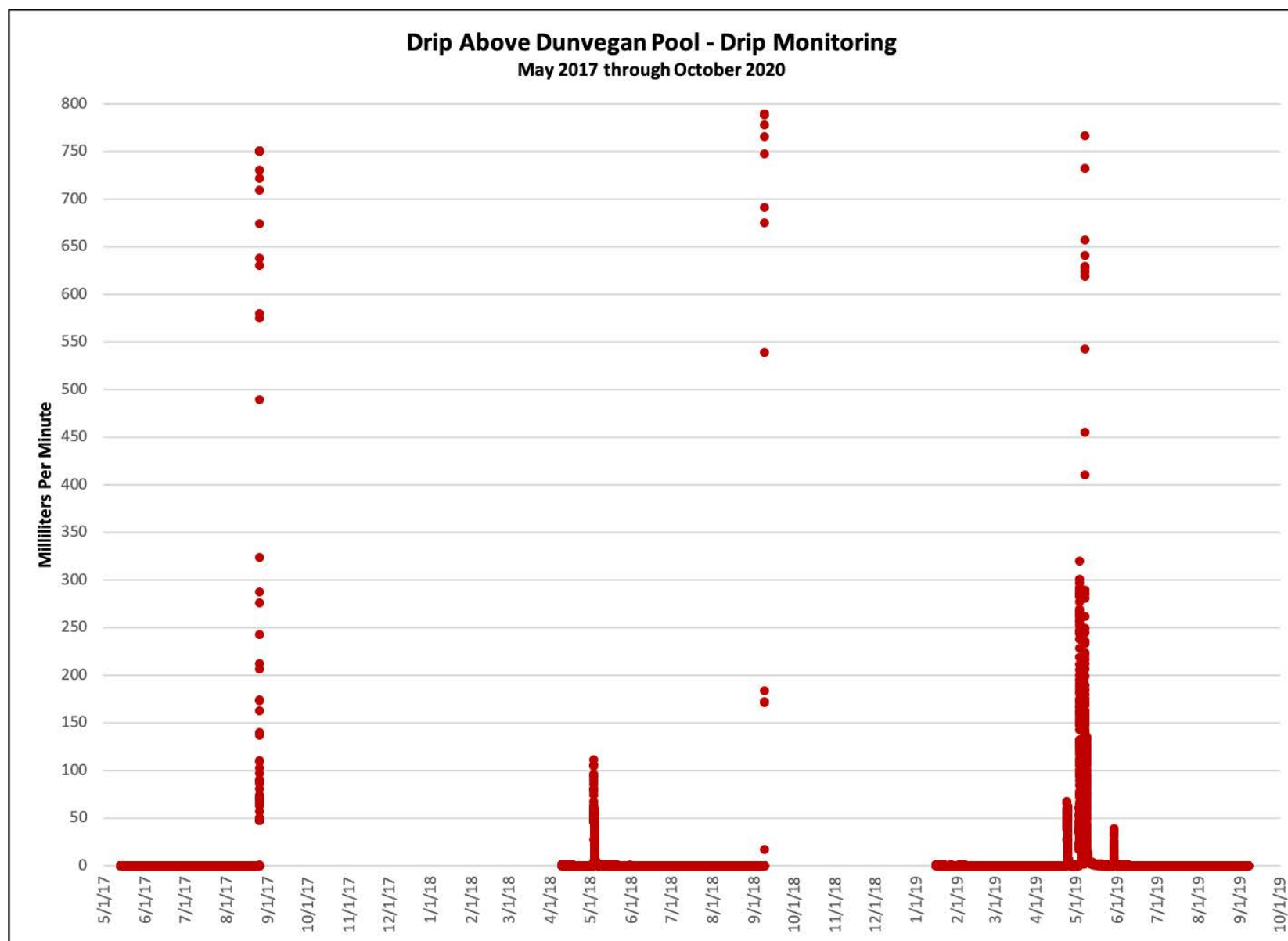
Mean **-.46** – Minimum 0.00 – Maximum **-604.4**

Good data collected 10/1/2019 through 2/15/2020. An attempt at data retrieval on October 14, 2020 was aborted due to suspected presence of bobcat.

Station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB







Dunvegan Drip
Discrete Cave Drip

This site is a discrete cave drip and is within the Kirschberg Member of the Edwards Group.

0 drip rate measurements *retrieved* during 2020.

112,318 drip rate measurements since April 2016.

Mean 0.18 – Minimum – 0.00 – Maximum 15.07

Statistical volumes above are in milliliters per minute.

On February 15, 2020 the datalogger had failed and was replaced. An attempt at data retrieval on October 14, 2020 was aborted due to suspected presence of bobcat.

Station is currently deployed and operational. The current configuration is an Onset RG3 tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64



On the left is the entire setup of the Dunvegan Dungeon Drip monitoring station and on the right is a closeup of a small (~.4in x ~.4in) square hole from which the monitored drip water issues into the cave.

Dunvegan Drip - Drip Monitoring
April 2016 through June 2019

The following table represents the data points visible in the scatter plot, categorized by their flow rate in milliliters per minute (mL/min).

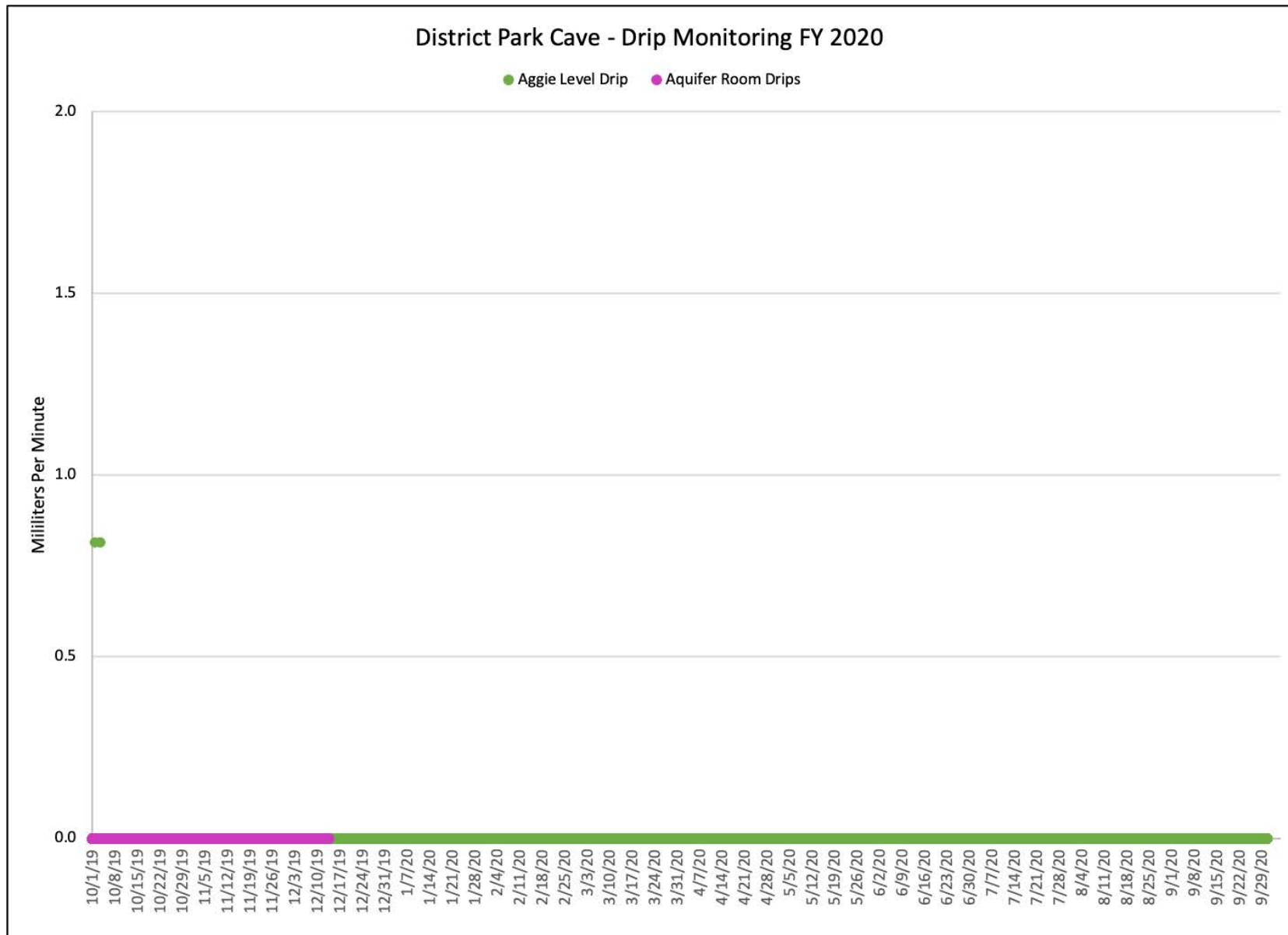
Date	Flow Rate (mL/min)
4/12/16	0, 0.7, 1.5, 2.4
5/12/16	0, 1.5, 2.4
6/12/16	0, 1.5, 2.4, 3.1, 4.0, 7.9
7/12/16	0, 1.5, 1.6, 2.4
8/12/16	0, 1.5, 2.4
9/12/16	0, 1.5, 1.6
10/12/16	0, 1.5
11/12/16	0, 1.5
12/12/16	0, 1.5
1/12/17	0, 1.5, 1.6
2/12/17	0, 1.5, 2.4
3/12/17	0, 1.5, 3.2, 3.2
4/12/17	0, 1.5, 3.2
5/12/17	0, 1.5
6/12/17	0, 1.5
7/12/17	0, 1.5
8/12/17	0, 1.5
9/12/17	0, 1.5
10/12/17	0, 1.5
11/12/17	0, 1.5
12/12/17	0, 1.5
1/12/18	0, 1.5, 2.4
2/12/18	0, 1.5, 2.4
3/12/18	0, 1.5, 1.6, 1.6
4/12/18	0, 1.5, 4.8
5/12/18	0, 1.5, 1.6
6/12/18	0, 1.5, 1.6
7/12/18	0, 1.5
8/12/18	0, 1.5
9/12/18	0, 1.5
10/12/18	0, 1.5
11/12/18	0, 1.5, 3.2
12/12/18	0, 1.5, 1.6, 1.6
1/12/19	0, 1.5, 2.4, 3.2
2/12/19	0, 1.5, 1.6, 1.6
3/12/19	0, 1.5, 1.6, 1.6
4/12/19	0, 1.5, 1.6, 1.6
5/12/19	0, 1.5, 1.6, 2.4
6/12/19	0, 1.5, 3.2, 6.3, 15.1

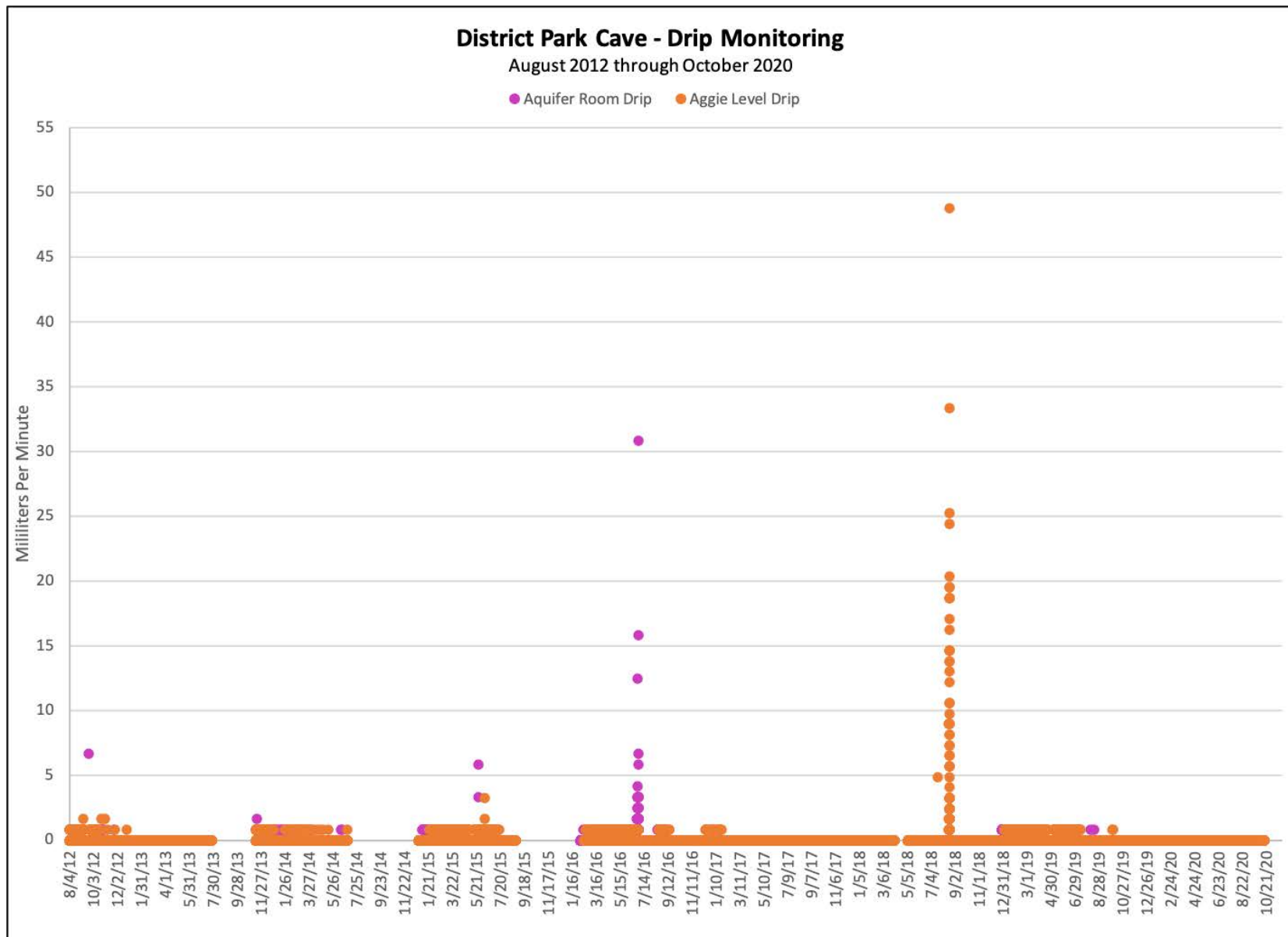
District Park Cave

District Park Cave is a well decorated cave located within Dick Nicholas District Park. The first section of cave was initially discovered by members of the Underground Texas Grotto, during the fall of 1984, after removing rocks and dirt from the entrance. In the spring of 1987, they discovered the main section of the cave after removing washed in fill at the low point where the gate is currently located.

Despite the known extent of the cave being relatively small, the speleogenic evidence suggests District Park Cave connects to a substantially large volume of cave. The Aquifer Room contains very nice examples of Cave Rims, which are formed via aerosol speleothem development. Their presence indicates a large volume of undiscovered cave. Given that these features were formed by airflow, yet they don't blow air today, one can conclude that the large volume of undiscovered cave is currently obscured by a recently formed plug.







Aquifer Room

Discrete Cave Drip

This site is a discrete cave drip and is within the Kirschberg Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

7,080 drip rate measurements during 2020.

Mean 0.00 – Minimum 0.00 – Maximum 0.00

144,565 drip rate measurements since August 2012.

Mean 0.01 – Minimum – 0.00 – Maximum 30.83

Deviation of 2020 drip rates from complete record:

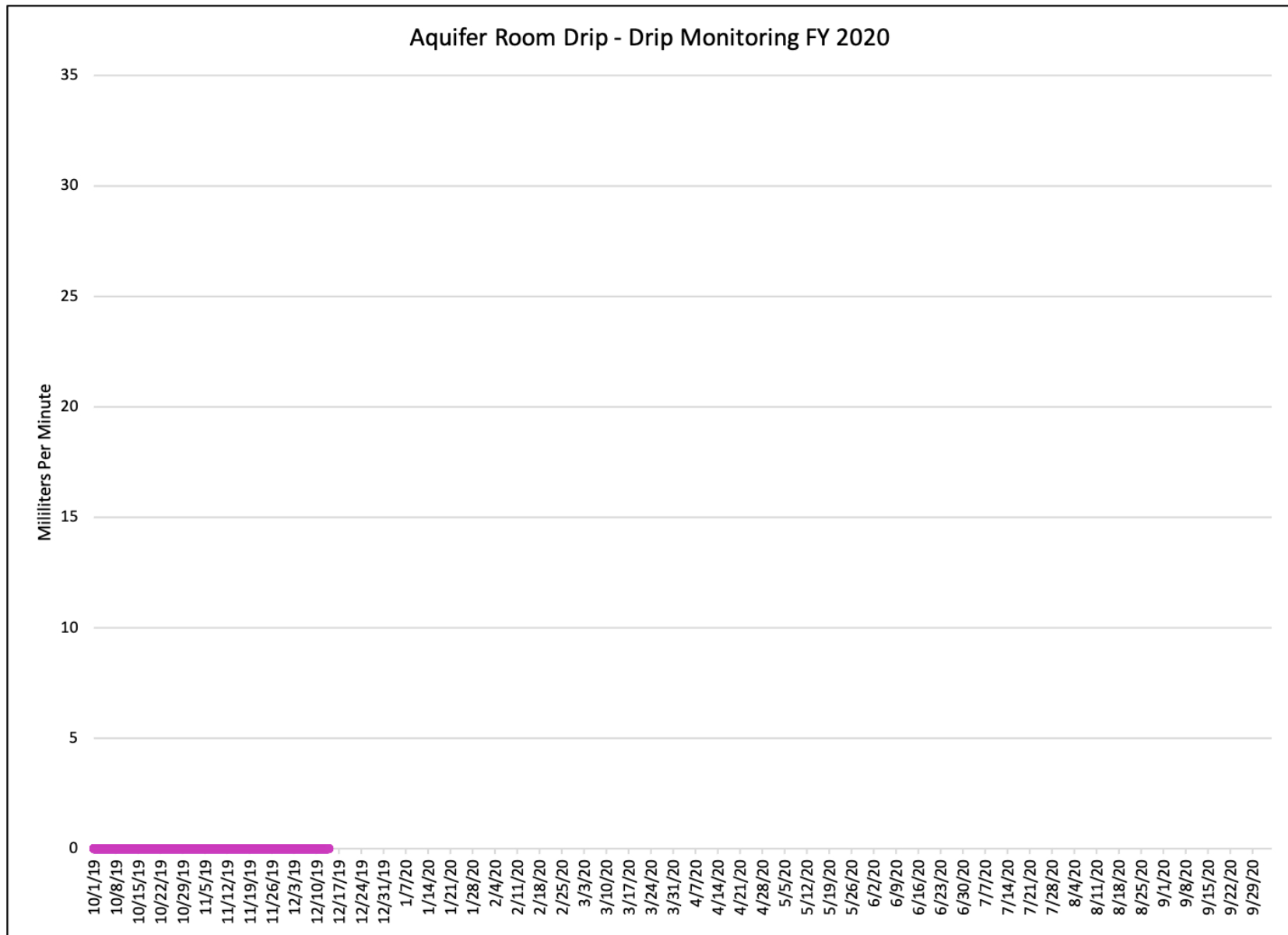
Mean -0.01 – Minimum 0.00 – Maximum -30.83

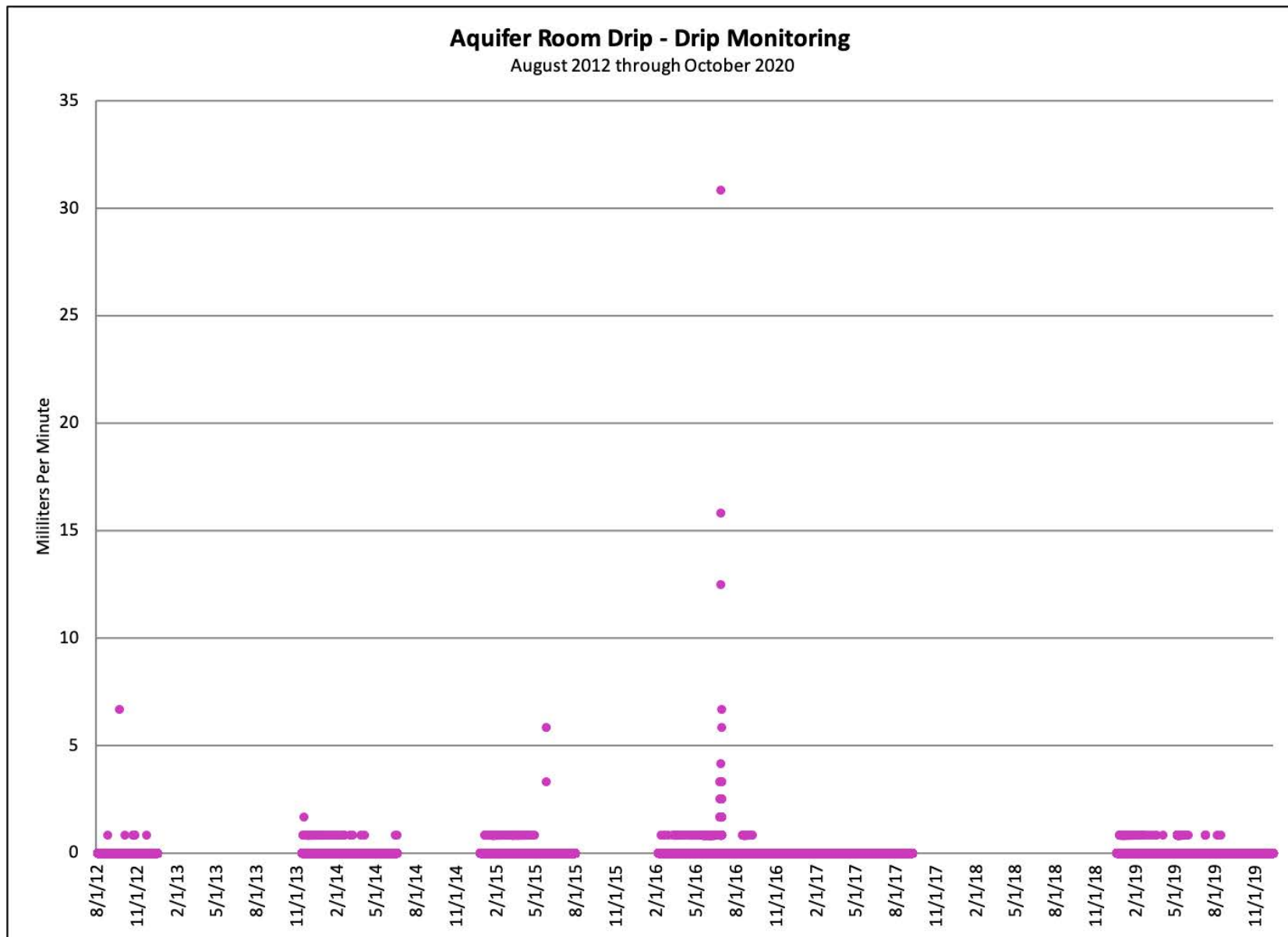
Good Data collected 10/1/2019 through 12/13/2019. The data gap is due to a datalogger failure wherein reading the logger header failed. The datalogger was replaced on 10/16/2020.

The station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO USB Micro Station Data Logger H21-USB



Cave Specialist Justin Shaw next to the Aquifer Room drip monitoring station.





Aggie Level

Discrete Cave Drip

This site is a discrete cave drip and is within the Kirschberg Member of the Edwards Group.

Statistical volumes below are in milliliters per minute.

35,109 drip rate measurements during 2020.

Mean 0.00 – Minimum 0.00 – Maximum 0.81

144,565 drip rate measurements since August 2012.

Mean 0.01 – Minimum – 0.00 – Maximum 30.83

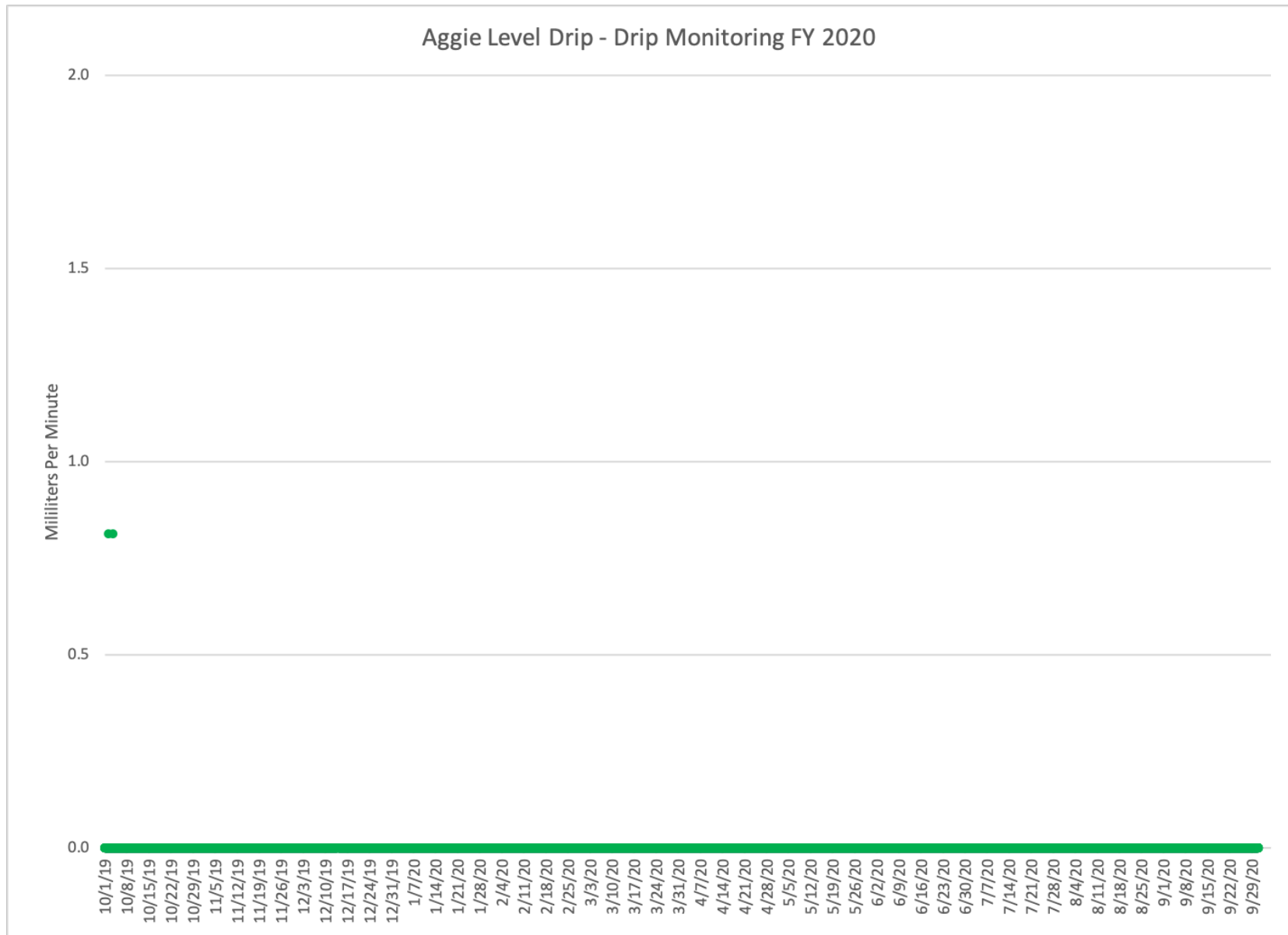
Deviation of 2020 drip rates from complete record:

Mean -0.01 – Minimum 0.00 – Maximum -30.02

Good Data collected all year.

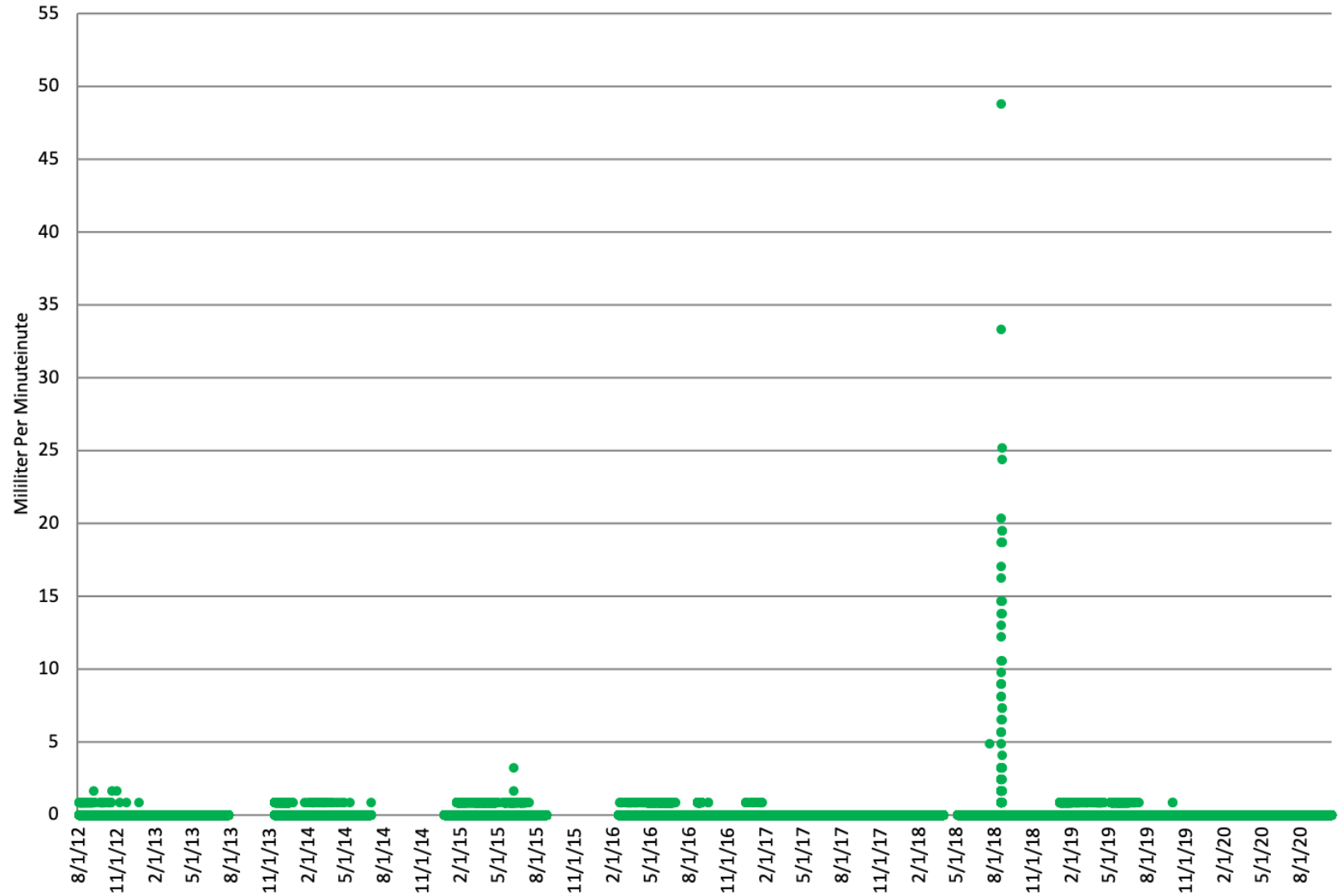
The station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64





Aggie Level Drip - Drip Monitoring

August 2012 through October 2020

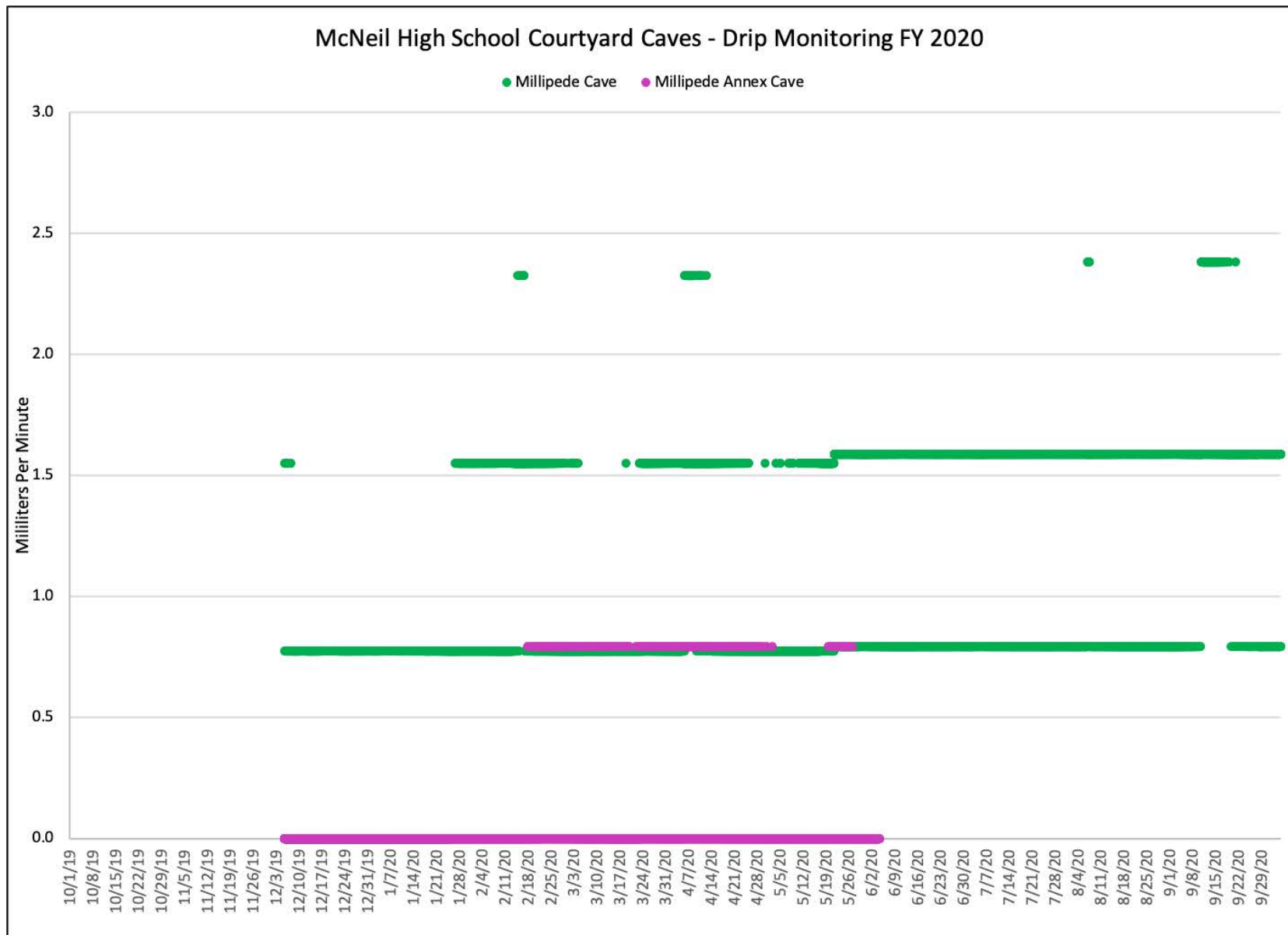


McNeil High School Courtyard Caves

Withing the courtyard of McNeil High School are two caves, Millipede Cave and Millipede Annex Cave. The hydrogeologic origin of these two caves is that of one cave; at some point long ago during its spelomorphology the system was separated into two caves by a collapsed sinkhole.



Speleothems crowding into the cave passage form the “dead end” of Millipede Cave



Millipede Bedding Plane Drips

Discrete Cave Drip

This site is a discrete cave drip consisting of three dripping stalactites out of 42 actively dripping stalactites which all form hanging from a bedding plane; and is within the Kirschberg Member of the Edwards Group.

Automated drip rate monitoring began on December 5, 2019.

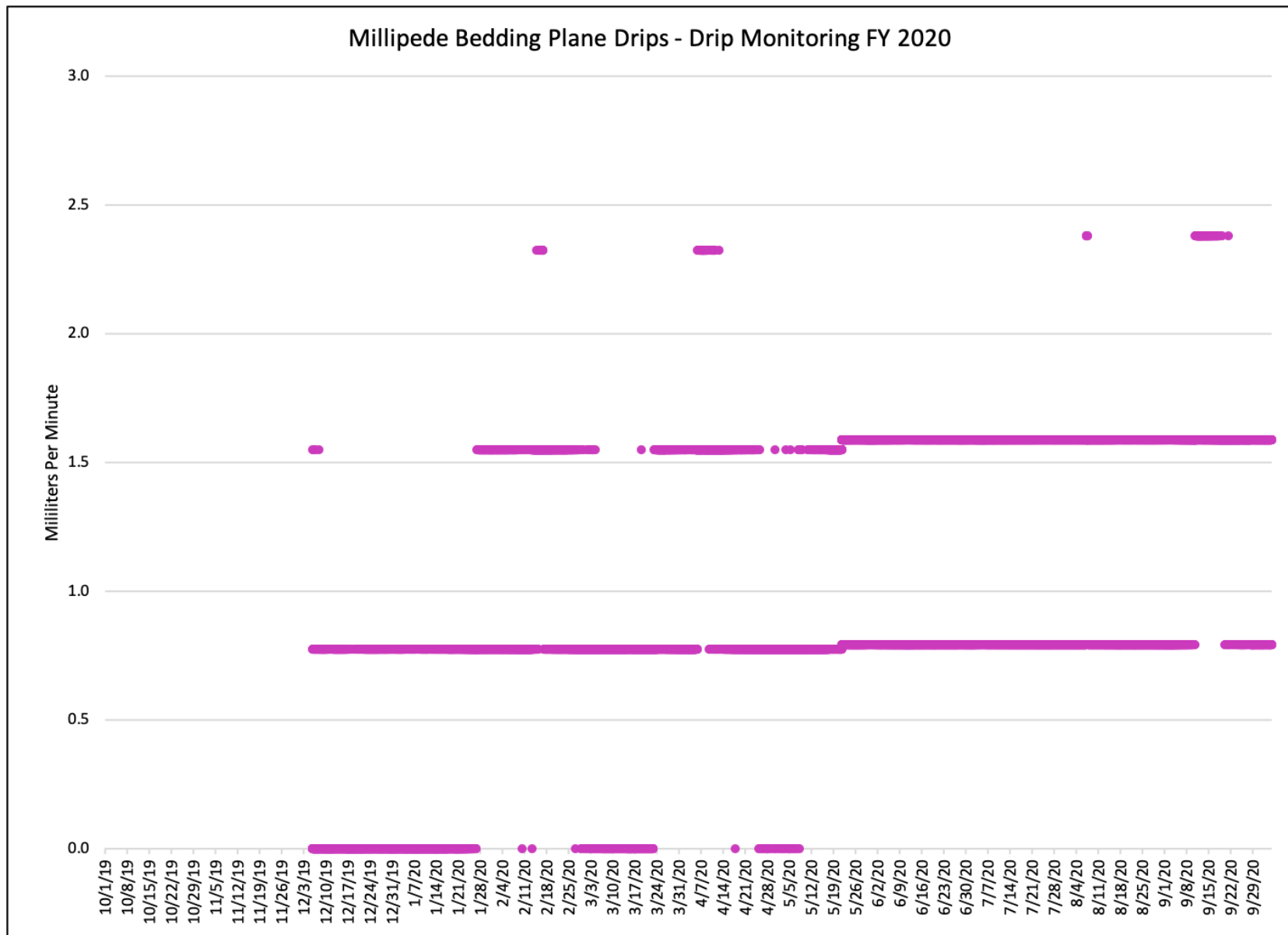
34,719 drip rate measurements.

Drip rate in Milliliters Per Minute: Mean 0.96 – Minimum 0.00 – Maximum 2.38

Good Data collected 12/5/2019 through 12/1/2020.

The station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64





Millipede Annex North Drip

Discrete Cave Drip

This site is a discrete cave drip and is within the Kirschberg Member of the Edwards Group.

Automated drip rate monitoring began on December 5, 2019.

17,445 drip rate measurements.

Drip rate in Milliliters Per Minute: Mean 0.06 – Minimum 0.00 – Maximum 0.79

Good Data collected 12/5/2019 through 6/4/2020. Data gap is due to datalogger failure for unknown reasons

The station is currently deployed and operational. The current configuration is a RainWise tipper connected to an Onset HOBO Pendant Event Data Logger UA-003-64



Panoramic photo inside Millipede Annex Cave

